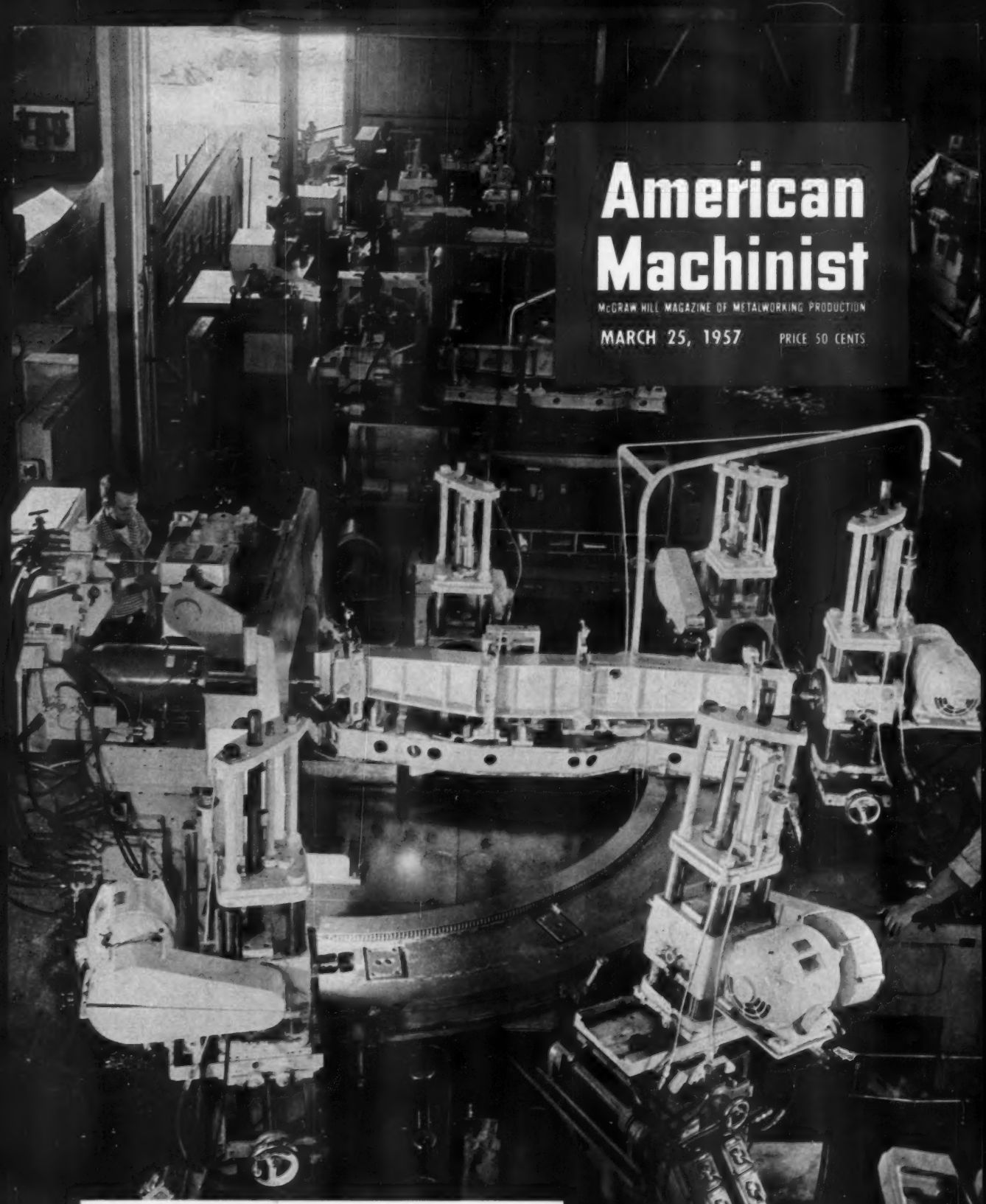


American Machinist

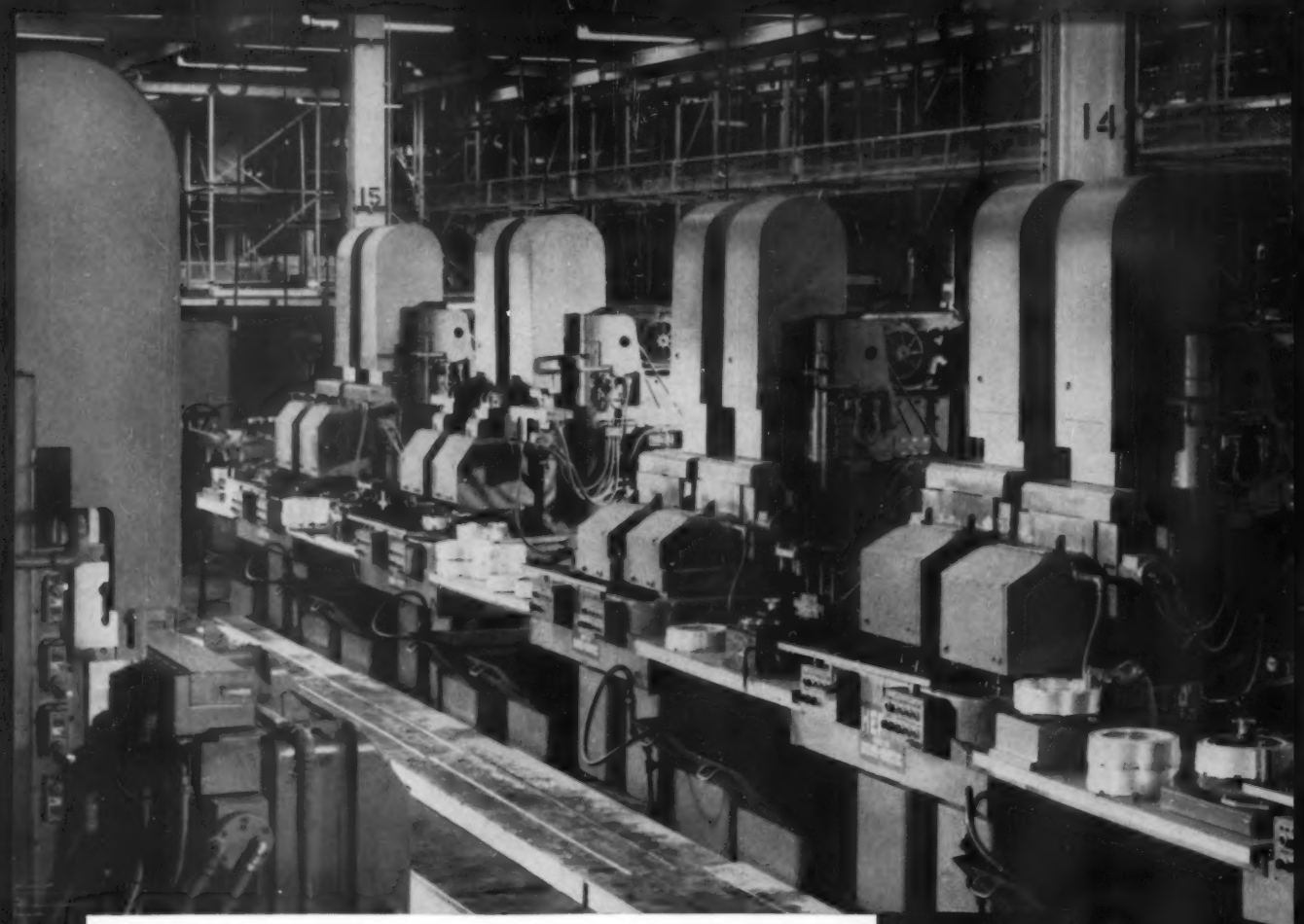
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

MARCH 25, 1957 PRICE 50 CENTS

HONEYCOMB! A SPECIAL REPORT
PAGE 137

Make the right plant layout
PAGE 121

"Erector-set" production line speeds design changes — see page 2



Here's how

VERTICAL Bore-Matics

can save time and money on many precision-finishing jobs

LESS FLOOR SPACE These compact Vertical Bore-Matics save precious floor space, make use of more available up and down areas, permit operator to handle more than one machine.

EASIER LOADING Parts located down and onto the fixture, not up and into the workholding device. All stations are *front* stations — less reach and stretch.

IMPROVED CHIP AND COOLANT CONTROL Vertical units lend themselves naturally to gravity control of chips and coolant by means of simple, effective guarding.

CONTINUOUS PRODUCTION Independent operation of each station provides maximum opportunity to keep stations cycling continuously except for loading and unloading time.

THESE are just a few of the reasons why many types of work can be handled more efficiently and economically on a Heald Vertical Bore-Matic than on any other type of precision-finishing machine. For further details, send for Bulletin 2-352-1, Issue 1.

Ten Model 352 VERTICAL BORE-MATICS precision finish 5 different automatic transmission parts

Shown above is an installation of Heald Vertical Bore-Matics in a large automotive manufacturing plant. These space-saving machines are used for high-production Borizing of the following automatic transmission parts:

- Disc and Hub Assemblies
- First Turbine Convertors
- Convertor Pump Housings
- Turbine and Shaft Assemblies
- Second Turbine Convertors

Versatility of cycling and ease of tool changing makes these units readily adaptable to future job changeovers.

IT PAYS TO COME TO HEALD

HEALD

THE **HEALD** MACHINE COMPANY

Worcester 6, Massachusetts

Subsidiary of The Cincinnati Milling Machine Co.

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

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American Machinist *Chips*

Cover . . .
"Erector-set" approach provides a production line at North American Aviation that is more adaptable to design changes. The procedure is described in the article on page 128.

Honeycomb . . . The most fascinating new material in years is the one we have taken from the bee. Honeycombs of paper, plastic, or metal laminated to skins of paper, plastic, or metal provide a light, strong structural material with many applications first in the aircraft industry and now spilling over into other fields. Builders of boats, mobile homes, truck bodies, automobiles, metal furniture, and appliances, please note.

One of the earliest approaches was the corrugated pasteboard box that is so familiar to all of us, but it was not until the switch was made from a corrugated to a honeycomb core that real structural applications were possible. Honeycomb has been talked about in articles for some time, but we have long felt it was desirable to round up all the information on forming, machining, and bonding in a Special Report. For quite a while we were stymied because there was too little information to be of any real value.

Recently the picture changed dramatically. Several studies of methods were completed at about the same time and large quantities of honeycomb began to find its way into production models of aircraft. The last job that E J Tangerman did for us, before he was transferred to our companion magazine *Product Engineering*, was to round up all this information and boil it down into a Special Report. As we said, the situation had changed dramatically in just a few months. From his calls upon the users of honeycomb and his contacts with the producers he had so much data that it was extremely difficult to pack it into one Report—in fact, we had to add a few pages to the issue to make it possible. Honeycomb applications, in addition to their direct usefulness, offer many new ideas for working and joining thin materials. You'll find this definitive summary starting on page 137.

For Reference . . . Three Reference Book Sheets in each issue of American Machinist are something that you and we take for granted. You might not realize the work that Rupert LeGrand puts into assembling those pages. For years Rupert has haunted standards committees and other sources of new reference data. Issue after issue he comes up with data that are new, but at the same time are of permanent file value. In this issue, for example, you'll find tables on a modified thread system that avoids manufacturing and assembly problems. Earlier this year he provided 12 sheets that gave illustrated definitions of tolerances and limits.

We are studying the possibility of perforating these Reference Book Sheets to make them easier to remove for filing. If this would be of help to you, drop a line to the managing editor and put a little pressure on . . . By the way, did you know that there is an annual index to the articles in American Machinist? The index for 1956 is available, free, on request.

Coming . . . *AM* for April 8 headlines a report on how American Bosch saved nearly a million dollars a year by a modernization program. The report gives the before-and-after details on the changes that made the difference. In addition to the usual departments, there will be a wealth of short articles on such subjects as inspection, induction hardening, deburring, and assorted articles on tools and fixtures.

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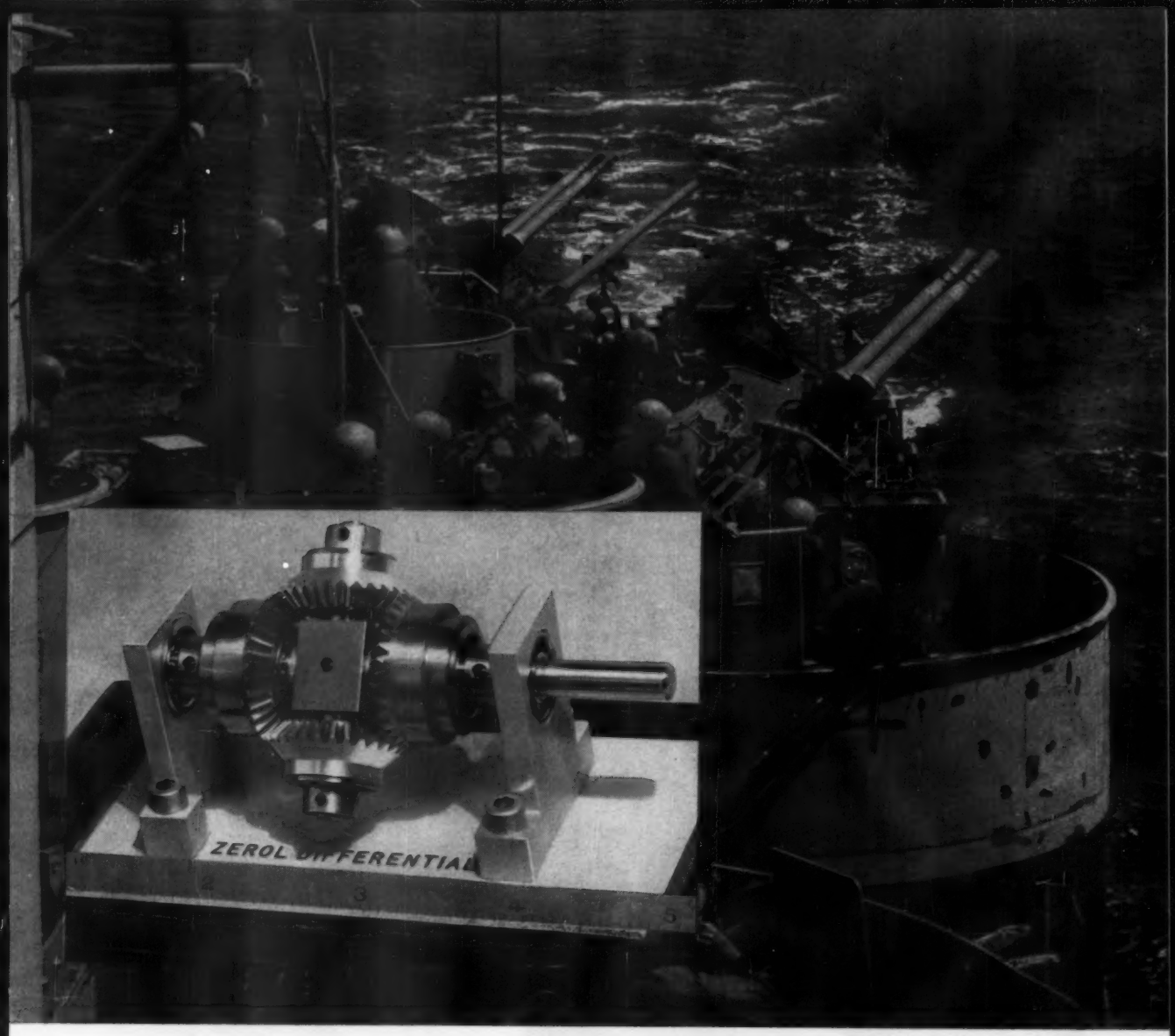

Official United States Navy Photograph

When your fine pitch gears *must be accurate*

When you work with fine pitch gears like those in this naval fire control unit differential, tolerances are critical.

Tooth-to-tooth accuracy is extremely important to permit the guns to be sighted precisely on target.

So where accuracy is really critical in the gears you make, Gleason can help you three ways:

1. Machines that cut or grind any fine pitch gear

You can produce any fine pitch gear—spiral bevel, hypoid, Zerol®, or Coniflex®—exactly and economically with any of five Gleason machines.

Three automatic gear-cutting generators cover the entire field of cut fine pitch bevel gears up to 4½" diameter. Two automatic, wet-type grinders are available for this same range of work and produce the ultimate in accuracy. All five work to your most rigid specifications.

2. Machines that test gears thoroughly

The Gleason No. 104 Hypoid Tester, for example, checks running qualities, tooth spacing, and concentricity of gears. It records test results on paper so that you have a permanent record of the total tooth-to-tooth composite error.

3. Engineering services

Gleason engineers are ready at all times to help you with any phase of the design and manufacture of fine pitch gears.

Simply write or phone for prompt assistance on any of your fine pitch gear requirements.

Send for these bulletins:

No. 2A Straight Bevel Coniflex® Generator
No. 103 Straight Bevel Coniflex® Generator
No. 2 Hypoid Generator
No. 105 Straight Bevel Coniflex® Grinder
No. 7 Hypoid Grinder
No. 104 Hypoid Tester

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Builders of bevel gear machinery for over 90 years

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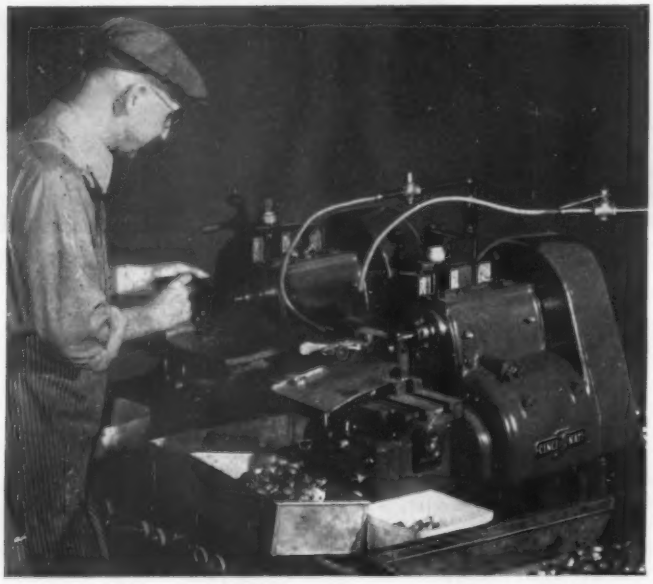
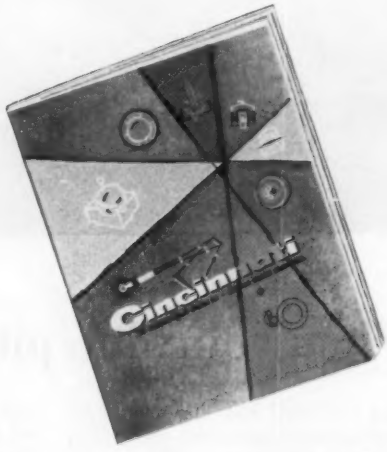
For Big Milling Jobs

...or small ones

Cincinnati will supply the equipment to meet your requirements



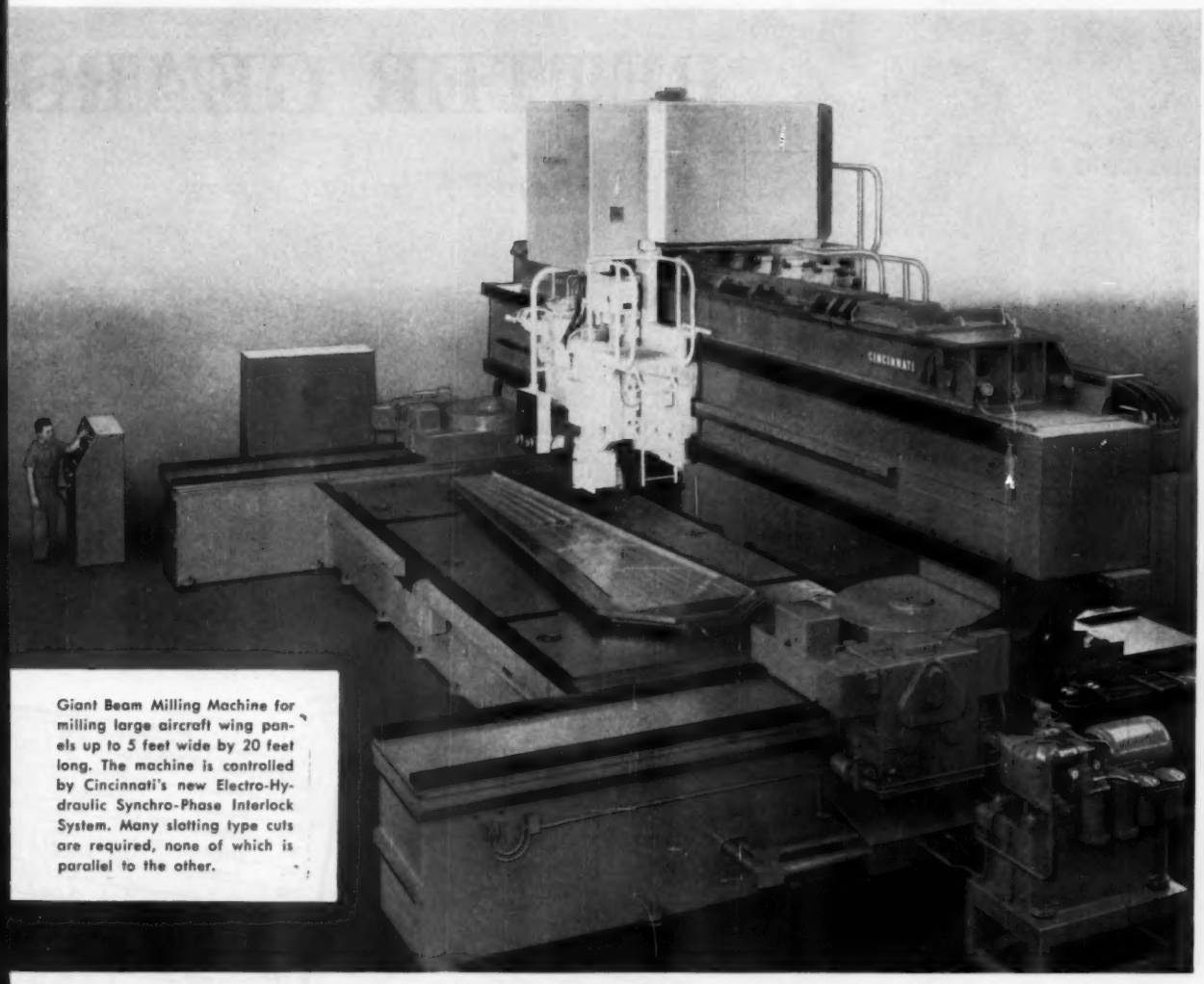


Left: The smallest of the Cincinnati line, No. 000-4 Automatic, mills sewing machine parts in the plant of a prominent manufacturer.

Above: New general catalog published by The Cincinnati Milling Machine Co. Publication No. M-1961.

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES



Giant Beam Milling Machine for milling large aircraft wing panels up to 5 feet wide by 20 feet long. The machine is controlled by Cincinnati's new Electro-Hydraulic Synchro-Phase Interlock System. Many slotting type cuts are required, none of which is parallel to the other.

Dump your cost-of-machining problems in our lap. The country's best metalworking industries have been doing it for over 30 years, and coming out way ahead in modern methods and low costs. Cincinnati Milling has the facilities, experience and line of standard equipment to fully satisfy your requirements. Milling machines built by Cincinnati range from the midget 000-4 Automatic at the left to this giant Beam Miller; hundreds of sizes and types in between; standard and specials. ¶ A new general catalog just off the press illustrates and briefly describes Cincinnati's complete line of standard machine tools, hardening machines, grinding wheels and cutting fluids. In addition, there's a section on special machine tools. You will find a duplicate of this catalog in Sweet's Machine Tool File. If you would like to have your own copy we will promptly send one to you. Ask for publication No. M-1961.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

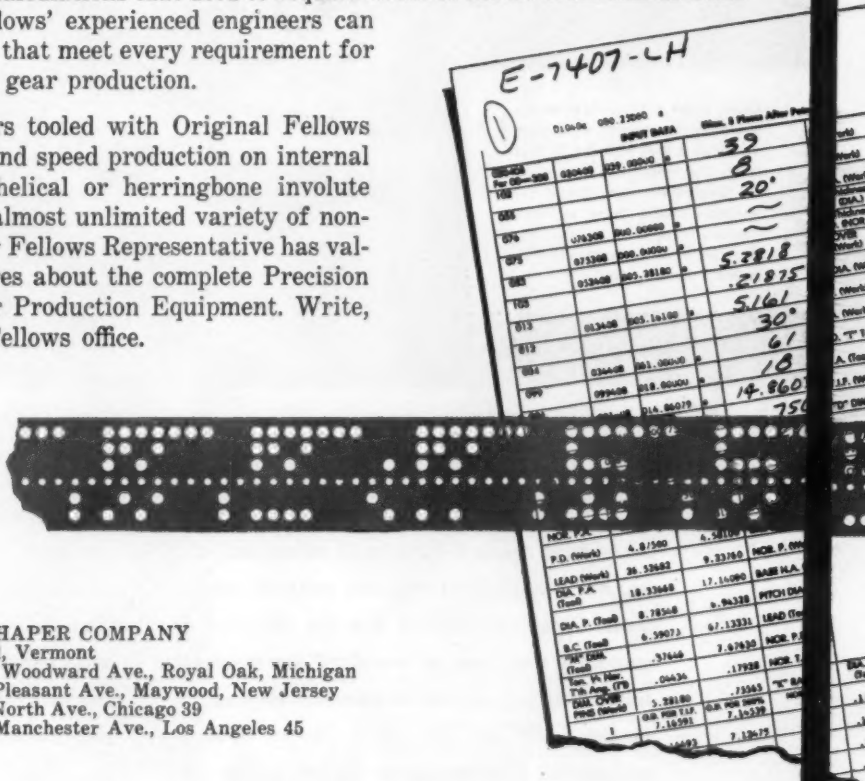
BETTER GEARS

Original Fellows Cutters "Computer-Designed"

Here's how Fellows ensures gear cutter design that meets your most critical requirements! A high-speed Bendix Computer (at right) shortens hours of calculations to minutes, permitting complete mathematical study of all the complex problems of gear and cutter design.

The punched tape holds the basic formulae. This is the computer "program." Variables for a particular Fellows Cutter, Shaving Tool, or Master Gear are typed on the electric typewriter which feeds them into the computer. As fast as the operator can type, the computer makes calculations that used to require hours of labor. With this modern calculating tool, Fellows' experienced engineers can better design cutters that meet every requirement for accurate, economical gear production.

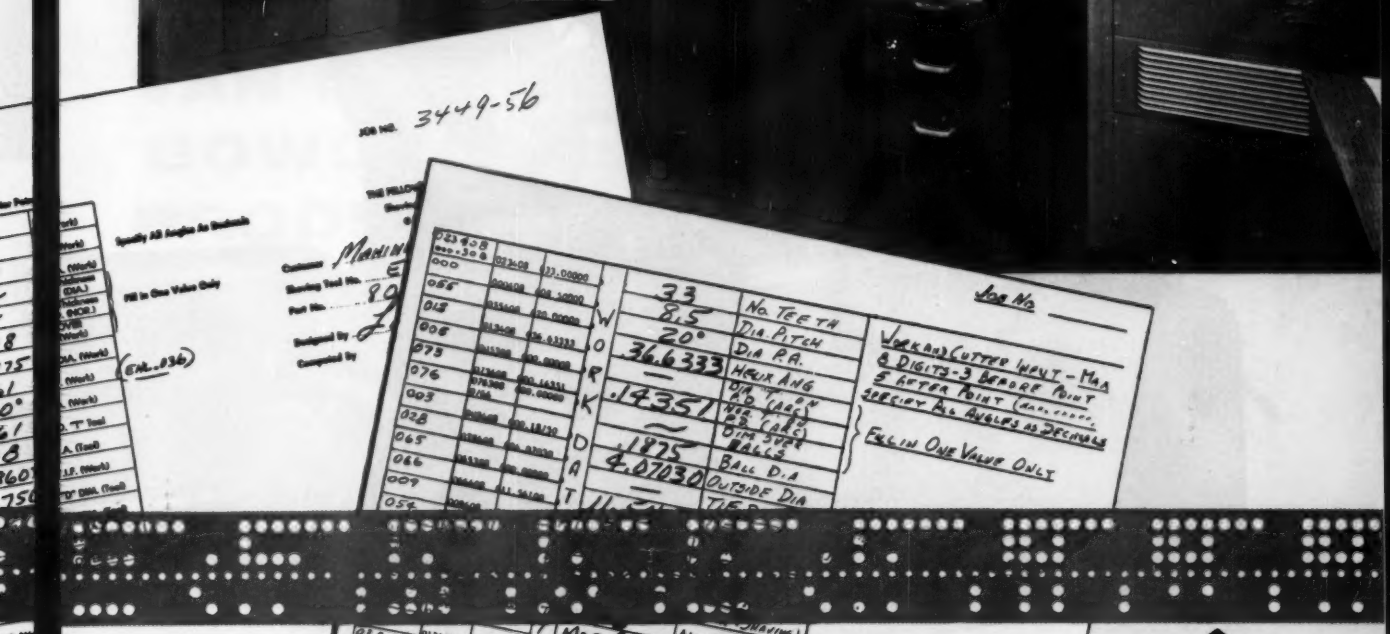
Fellows Gear Shapers tooled with Original Fellows Cutters lower costs and speed production on internal and external spur, helical or herringbone involute gears, as well as an almost unlimited variety of non-involute shapes. Your Fellows Representative has valuable facts and figures about the complete Precision Line of Fellows Gear Production Equipment. Write, wire or phone any Fellows office.

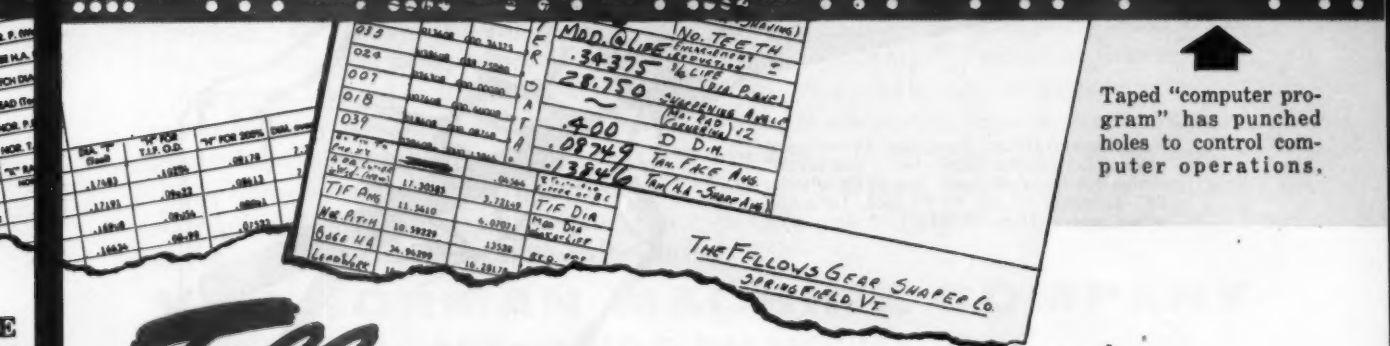


THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
150 West Pleasant Ave., Maywood, New Jersey
5835 West North Ave., Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE

START HERE!

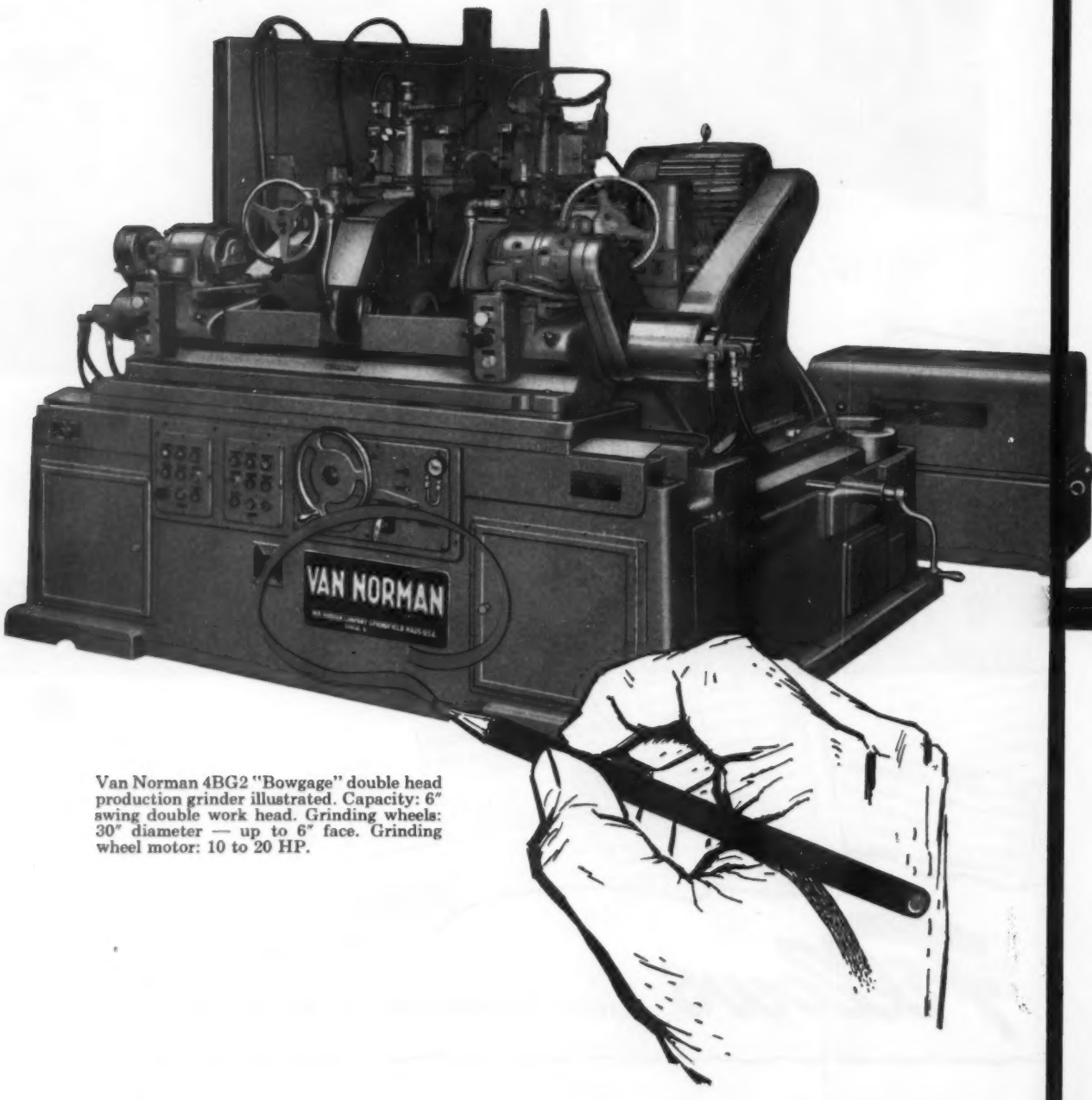

JOB NO. 3449-56
JOB No.
33 NO. TEETH
8.5 DIA PITCH
20° DIA P.R.
36.6333 HELIX ANG
.1435 DIA OVER BALLS
.1875 BALL DIA
4.07030 OUTSIDE DIA
WORK AND CUTTER INPUT - MAX 8 DIGITS - 3 BEFORE POINT 5 AFTER POINT (MAX. ERROR .000005) SPECIFY ALL ANGLES AS DECIMALS
FILL IN ONE VALUE ONLY



Taped "computer program" has punched holes to control computer operations.

Fellows *Gear Production Equipment*

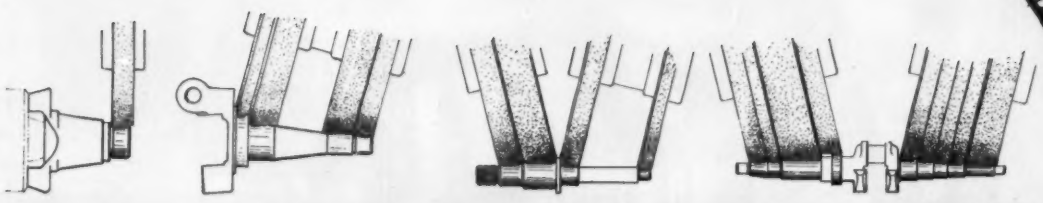
The Accent is on



Van Norman 4BG2 "Bowgage" double head production grinder illustrated. Capacity: 6" swing double work head. Grinding wheels: 30" diameter — up to 6" face. Grinding wheel motor: 10 to 20 HP.

Production

when you use a
VAN NORMAN "BOWGAGE" PRODUCTION GRINDER



Here are sketches of several actual applications performed for users of single and double head Bowgage Production grinding machines.

"Engineered for the job," the Van Norman 4BG "Bowgage" Production Grinder gives you accurate, fast, economical mass production.

Actual case histories on these massive grinders continually show substantial savings by keeping production up and costs down.

Van Norman production grinders can help you with your mass production problems. Write, wire or telephone, today, for complete details on the Van Norman 4BG "Bowgage" Production Grinders.

Don't wait . . . for extra profit install a Van Norman "Bowgage" Production Grinder now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

VAN NORMAN MACHINE COMPANY

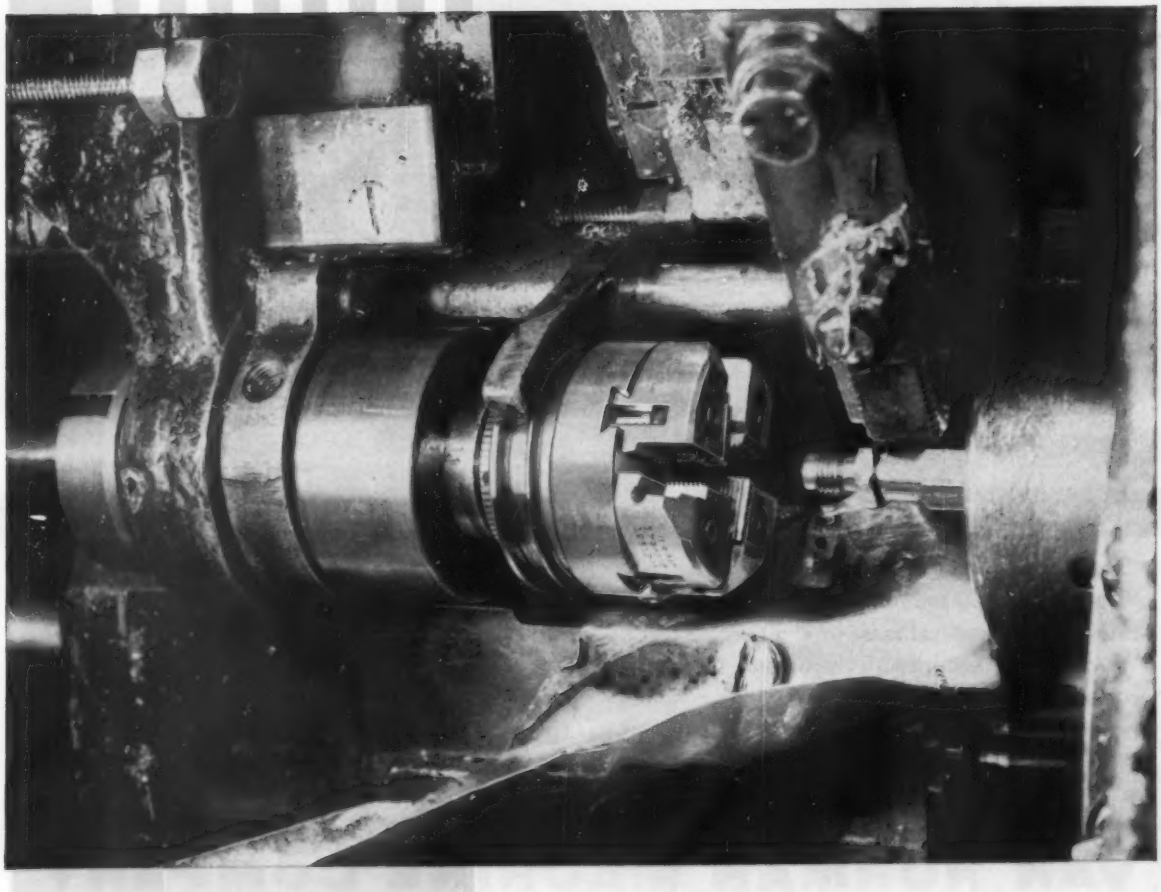
SPRINGFIELD 7, MASSACHUSETTS

A DIVISION OF VAN NORMAN INDUSTRIES, INC.

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

LANDIS

Economy Limited Clearance



Threading On Automatics....

To assure economy threading on automatic screw machines where limited die head clearance is a major factor Frank H. Wilson Co., Inc. in Detroit, Michigan use the ½" LL LANDEX Head. Applied to one of their small Acme-Gridley's for threading tubing nuts this head cuts ½", 20 pitch UN threads ⅜" in length on B1113 screw stock to a class three fit. An average of 20,000 pieces are threaded between chaser grinds.

Compactly designed with only a 2 7/16" swing the ½" LANDEX will thread all diameters from #4 to ½". A minimum number of working parts made of hardened and ground alloy steel, chaser holders designed to eliminate warpage and springing, and the use of precision LANDIS Tangent Chasers - - - all contribute to the high degree of rigidity and accuracy of this LANDEX Head.

Compare the chaser lengths in the illustrations and note the long life this LANDIS User has received from the chasers used in this application. These chasers will still produce thousands of threads as (1) LANDIS Tangential Chasers are usable for 80% of their original length; (2) only a few thousandths of metal need be removed from a chaser when regrinding; (3) when regrinding the same amount of metal need not be removed from each chaser; (4) long chaser life is received between grinds. These are the basis for economy in any threading operation.

For further information on this LANDEX Head and on other LANDIS Heads using Tangential Chasers and designed for all types of thread-cutting operations write for Bulletins F-80 and F-90. Please send specifications when writing.

THE WORLD'S LARGEST MANUFACTURERS OF THREAD GENERATING EQUIPMENT

395-C

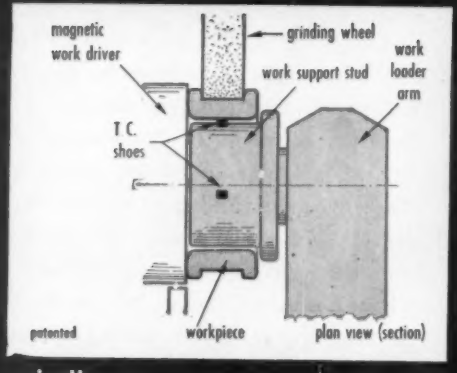
THE LANDIS *Machine* CO. WAYNESBORO PENNSYLVANIA

NEW automatic grinder for

Shoe-type centerless tooling

loading

grinding



grinding

unloading

parts like these ground to precision limits—automatically

LANDIS TOOL COMPANY

large or small lot production

can be changed in less than one hour!

Landis 4" Automatic Concentric Grinder with work feeder and discharge chutes.

Cost-Cutting Advantages of the Landis Concentric Grinder

- Savings in set-up time make automatic operation for short runs economical.
- Super-precision results by elimination of work holding chucks, collets and arbors.
- Grinds straight or profiled workpieces.
- Automatic loading and feedback can be applied for continuous operation.
- Variable speeds and feeds for various sizes and materials.

WAYNESBORO, PENNSYLVANIA

LANDIS

precision grinders

GIDDINGS & LEWIS

(MODEL 300-T)

precision horizontal boring, drilling and milling machine

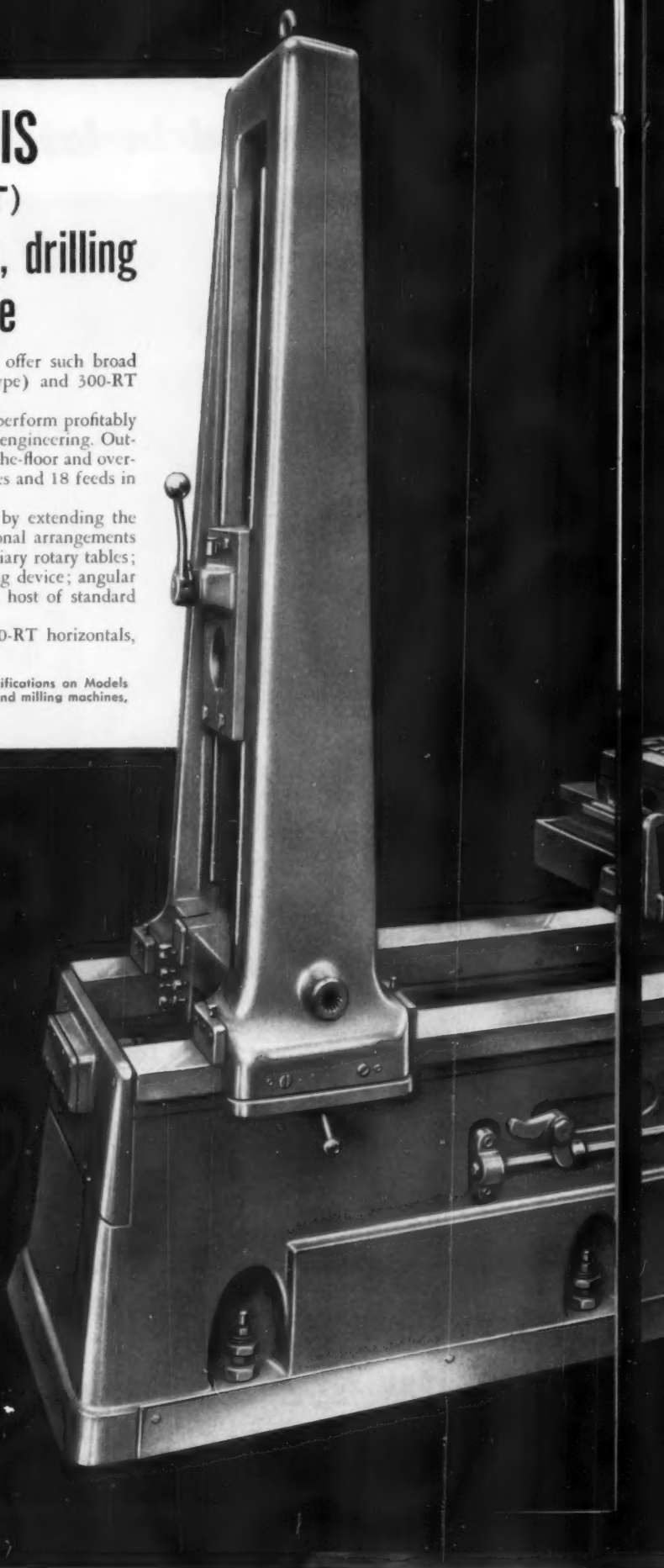
No other horizontal bars of comparable size and type offer such broad machining possibilities as G&L Models 300-T (table-type) and 300-RT (revolving table-type) with 3" diameter spindle.

These versatile boring, drilling and milling machines perform profitably without loss of down time because of G&L's progressive engineering. Outstanding design features include rigid saddle support, in-the-floor and over-the-floor auxiliary runways, 45 optional speeds in 5 ranges and 18 feeds in any range — augmented by a total of 23 milling feeds.

Profitable production capacities are further increased by extending the machine's normal working range with a variety of optional arrangements and attachments: quick change spindle (optional); auxiliary rotary tables; automatic electric positioning device; improved measuring device; angular milling attachments; continuous feed facing head and a host of standard Davis boring bars and cutters.

For more information on the Models 300-T and 300-RT horizontals, see your nearest G&L representative or write direct.

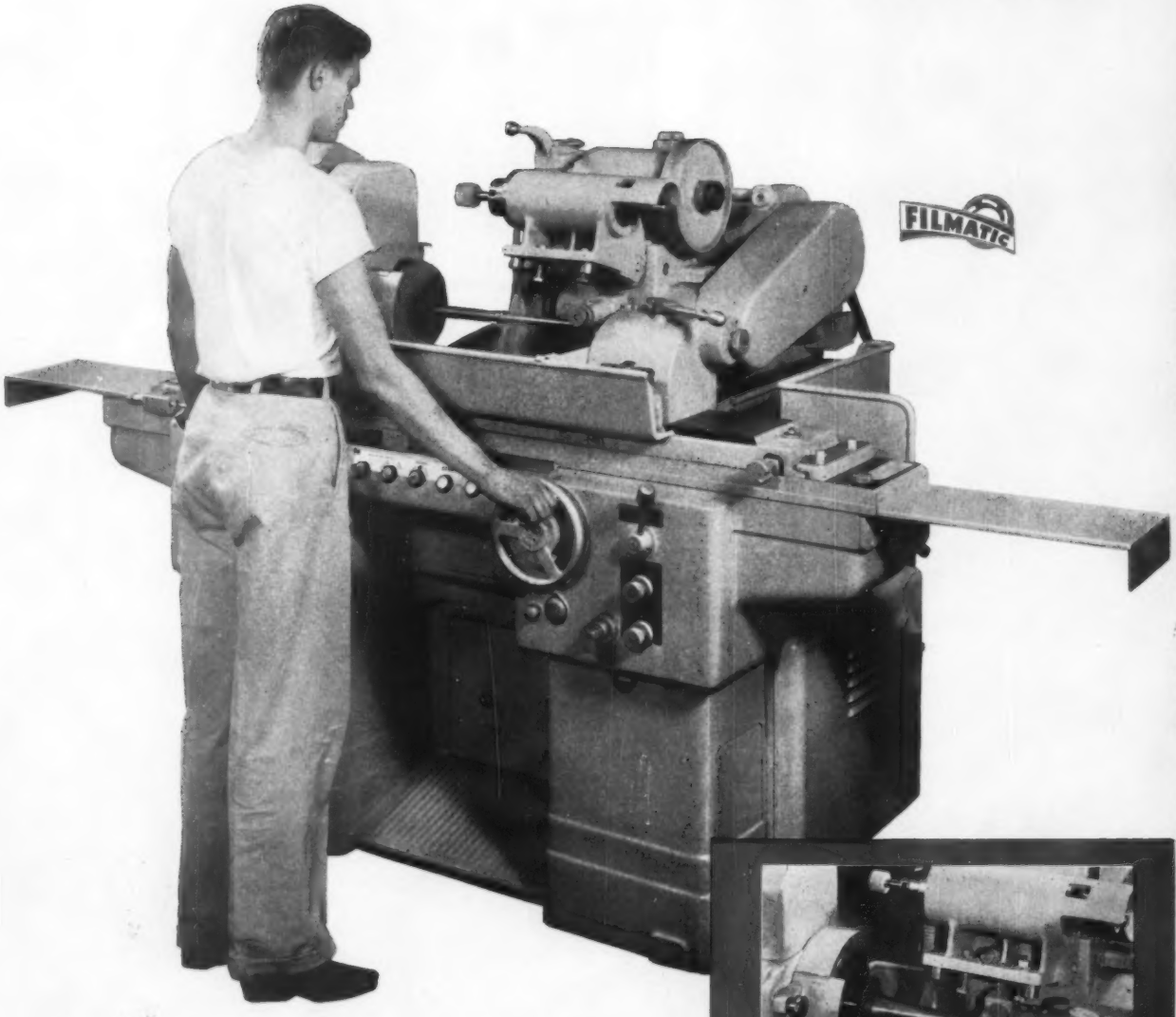
LITERATURE AVAILABLE: For complete specifications on Models 300-T and 300-RT horizontal boring, drilling and milling machines, write for Bulletin No. 300-T.



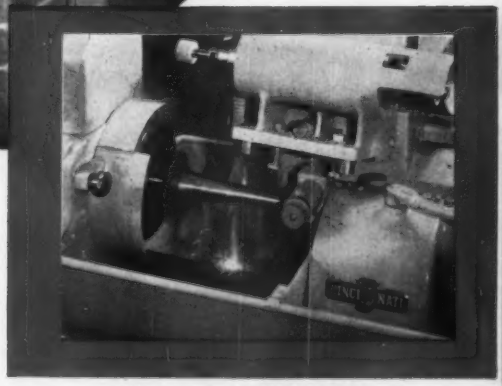
G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN G-73

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

This CINCINNATI Precision



Grinding a slender shaft . . . one of many types of precision toolroom and production grinding operations performed on CINCINNATI FILMATIC 10" Universal Grinding Machines.



Traverse grinding a taper. Amount of taper ground on these machines can be as much as 4½" per foot.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

UNIVERSAL

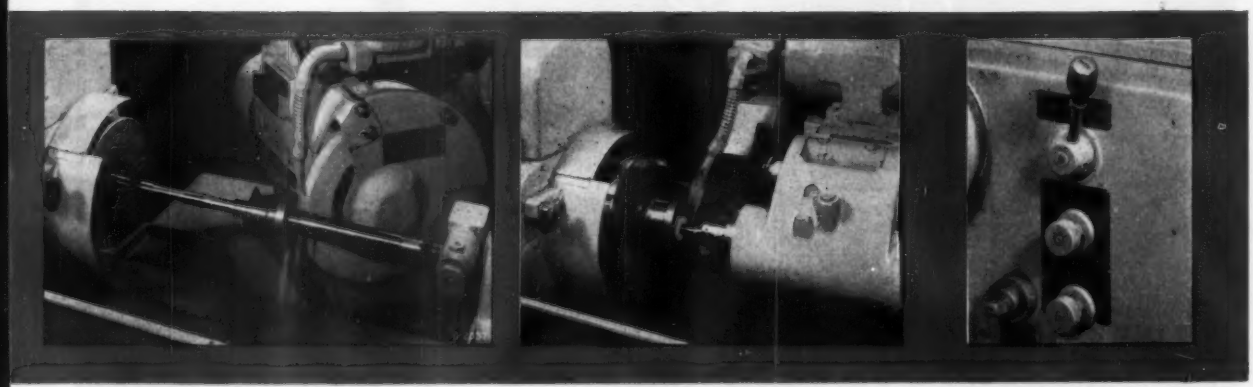
Grinds One Part or Hundreds

Look at your universal grinders from this viewpoint: when the need arises, can they handle big quantities at the low cost expected of high production equipment? It's routine work for the CINCINNATI® FILMATIC 10" Universal illustrated here. In addition to an unusual degree of versatility, this machine is equipped for automatic infeed grinding. For this type of work, a movement of one hand initiates the complete grinding cycle . . . rapid advance wheel to work, grind, tarry, return, and start and stop headstock rotation and coolant flow. ¶ The 10" Universal's extra measure of power is a big factor in both toolroom and production work. Consider these items compared to other machines in its class:

Largest grinding wheel: 12" diam. x 1½" face
Most powerful wheelhead motor: 2 hp
50% larger headstock motor
Exclusive FILMATIC grinding wheel spindle bearings

In addition to all these production advantages, the CINCINNATI FILMATIC is a true universal. Wheelhead swivels 180° and 220°, upper and lower, respectively; headstock swivels 180°; headstock speeds are infinitely variable 60 to 600 rpm. Want more information? Sweet's Machine Tool File contains brief specs. Complete data in catalog No. G-577-5.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



Interchangeable drive and grinding wheel, for grinding the right-hand face of shoulders. An excellent finish is produced with this equipment.

Internal grinding, one of the many operations performed at low, low cost on CINCINNATI FILMATIC 10" Universal Grinding Machines.

Automatic infeed elements. This type of equipment is built-in at the factory, does not restrict versatility of the machine in any way.

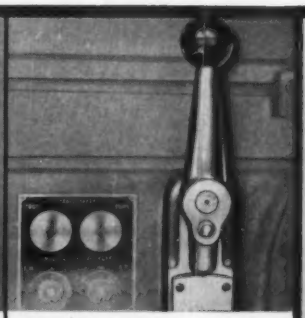
GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Profits in easy reach....

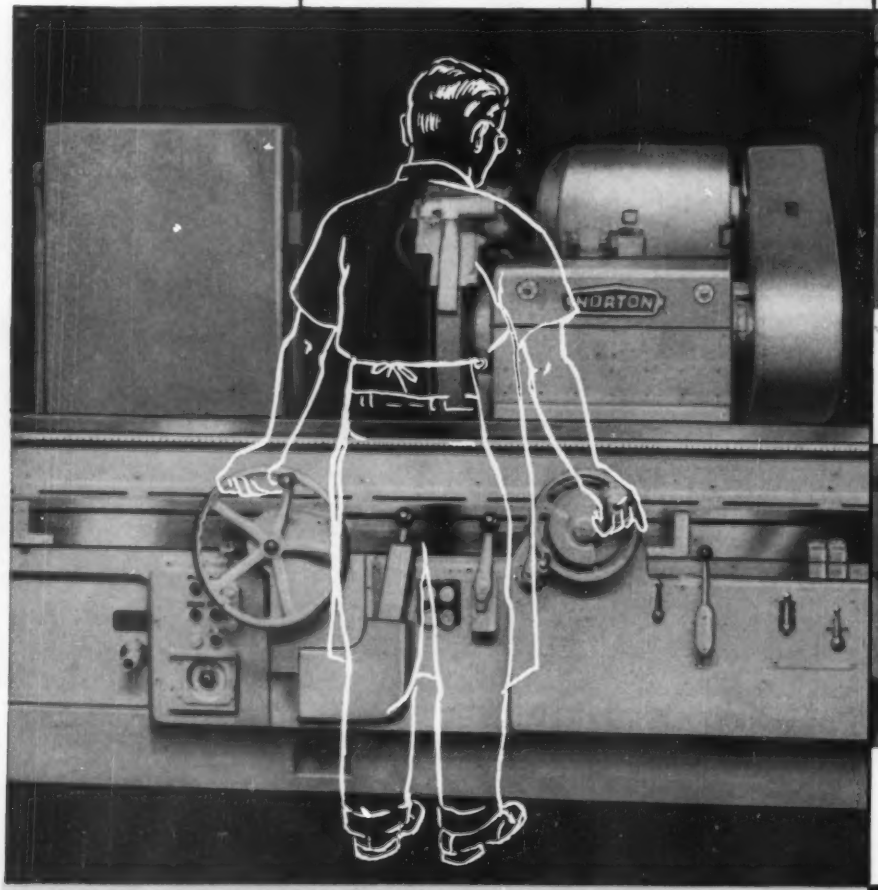
Flip this switch to set work rotation and coolant flow for manual operation or automatic operation with the cycle.

Use this lever to jog work rotation for roundness inspection or unloading.

Turn these knobs to set separate dwell controls for each end of table travel.



Use this lever to select preset table-truing or grinding speed — eliminating need for continual re-settings.



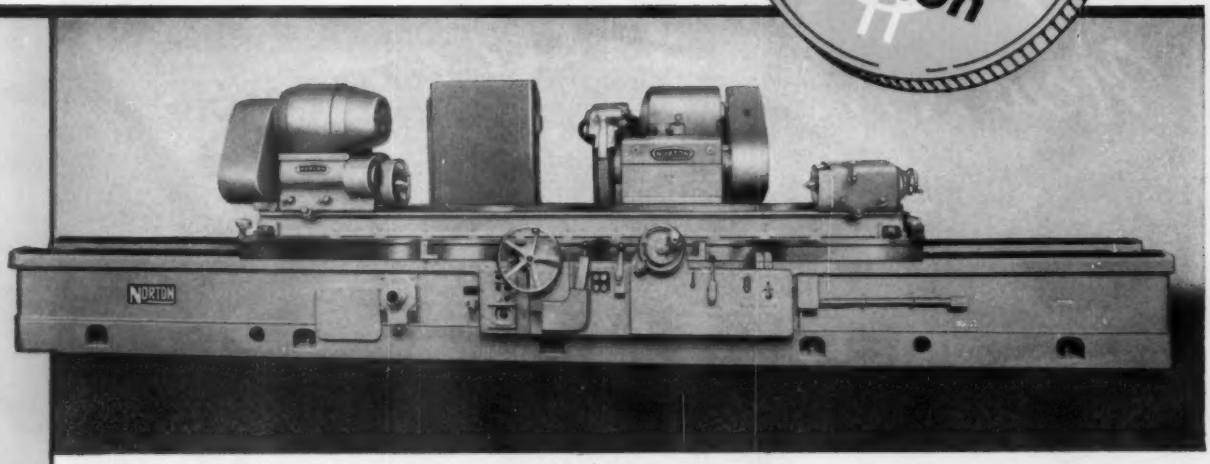
All controls for feeds and speeds within easy reach.

Count the indexing clicks on this wheel-feed handwheel for work diameter reduction in increments as fine as .0001".

Use this simple control for adjusting automatic feed from zero to .003". Total automatic feed is .150" on diameter, with automatic reset after grinding to size.

with two new advanced design Norton Cylindrical Grinders

Cut waste motion



The Norton 14" x 96" Type C-2 Semiautomatic Cylindrical Grinder — one of two sizes of new cylindrical grinders just announced by Norton.

The other is the 18" Type LC-2. Work length capacities of 36", 48", 72", 96", 120", 144" and 168" are available.

Feed and Speed Adjustments all on front of 14" Type C-2 and 18" Type LC-2 Grinders . . . Key Maintenance Points Easily Accessible

Features on these two new Norton cylindrical grinders mean more profit because they eliminate waste motion.

Operators of the 14" Type C-2 and 18" Type LC-2 need never leave their normal positions to make changes in settings. Controls are all at their fingertips.

All equipment needing occasional inspection is in easy reach. Electrical controls are grouped in an elevated enclosure. Motors, pumps, filters, pressure relief valves, and ways lubricant valves are all mounted on the outside for inspection or service.

The machines incorporate the proved Norton wheel spindle design, positively controlled micrometer-fine wheel feed design and generous, rugged overall construction to insure highest productive capacity and unsurpassed sizing control. They assure lowest costs in producing highest quality parts.

These features and many more give you the "Touch of Gold", by making your grinding more profitable. And only Norton can bring you the long experience with both grinding machines and wheels that is engineered into these advanced machines.

Ask Your Norton Representative

for more facts about the new 14" Type C-2 and the 18" Type LC-2 cylindrical grinders. Or write direct to NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

***To Economize, Modernize with* NEW**

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

Norton Products: Abrasives • Grinding Wheels • Grinding Machines • Refractories
Behr-Manning Products: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

District Offices:
Worcester • Hartford • Cleveland • Chicago • Detroit

ARMSTRONG
GENERAL CATALOG NO. 57

Listing approximately 5,000 quality tools for industry, including:

- ★ Tool Holders (The complete Armstrong System)
- ★ Cutting Tools (Tool Bits, Cut-off Blades, Carbide Cutters and Inserts)
- ★ Lathe and Milling Machine Dogs
- ★ Set-up and Hold-down Tools
- ★ Machine Shop Specialties
- ★ Drop Forged "C" Clamps
- ★ Parallel and Machinists' Clamps
- ★ Drop Forged Eye Bolts and Hoist Hooks
- ★ Drop Forged Machine and Crank Handles
- ★ Drop Forged Wrenches
- ★ Detachable Sockets and Drive Parts
- ★ Bridge Ratchets and Sockets
- ★ Adjustable Wrenches
- ★ Torque Wrenches
- ★ Pipe Tools
- ★ Chain Tongs

No industry reference file is complete without the new Armstrong No. 57 Tool Catalog

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.

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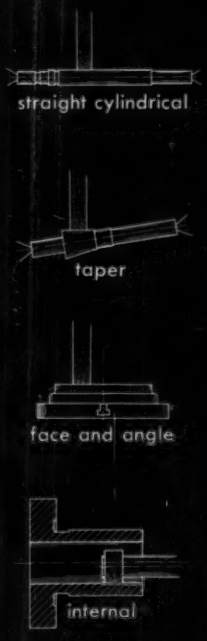
Low cost grinding of small parts... Landis Grindwell general purpose cylindrical grinder

for:
manufacturing
maintenance
toolrooms
training

here's how you save:
low first cost
quick change of setup
high precision
simplified maintenance

typical grinding operations

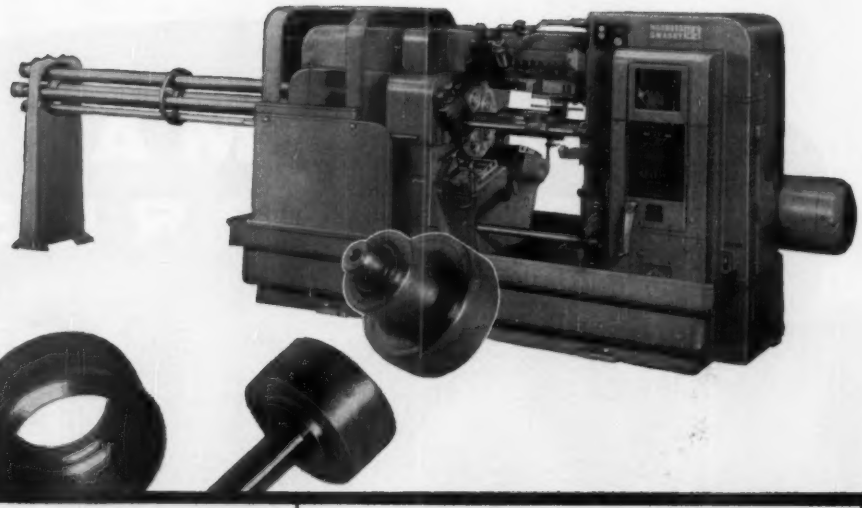


LANDIS
precision grinders
LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

Warner & Swasey's cost-cutting Automatics boost production for Thor Power Tool Company

Look at these typical time and cost savings delivered by Warner & Swasey 5-Spindle Automatic Bar Machines at Thor Power Tool's Aurora, Illinois plant.

YOU CAN PRODUCE IT



AUTOMATIC BAR MACHINES
1¼" Bar Capacity
1¾" Standard Capacity
2¼" Oversize Capacity

AUTOMATIC CHUCKING MACHINE
6" Swing

Reduction Gear Blanks

Savings pay for several new machines!

Large variety required—in lot sizes of 150-1500 pieces. Material — 8460 Steel.

Previous method — 2 single-spindle automatics, running continuously.

NOW — One Warner & Swasey 5-Spindle Automatic does complete machining in equivalent of 4 days a week.

Lock Collar

Slashes machining time on longer runs!

Quantities — 20,000 - 30,000 pieces.

Previous method — Run on conventional multi-spindle automatics in 75 seconds.

NOW — on Warner & Swasey 5-Spindle Automatics parts made in 27 seconds!

Thin Walled Protection Nut

Combines operations at high removal rate!

Previous method — Three operations — rough turned, relief cut made in second operation, Class 3 threads hobbed in third. Cost of last step alone ran 20 cents per part.

NOW — finished in one operation in 132 seconds on Warner & Swasey 5-Spindle Automatic.

Reducer Bushing

Cuts Class 4 threads in same operation — costs reduced 8.5 to 1!

Previous method — Threads milled, following rough forming on single-spindle automatic.

NOW — Complete machining finished on Warner & Swasey 5-Spindle Automatic in one operation in 27 seconds!

Sanding Pad Nut

One machine does work spread over 3 departments!

Problem — To thread part at perfect 90° angle to outside face, and hold concentricity.

Previous method — Part machined in 3 different departments. Difficulty was experienced in holding piece in fixture for knurling.

NOW — Thread tapped into bar stock and balance of cuts made, including knurling, in one operation on Warner & Swasey 5-Spindle Automatic.

Drive Shaft Impact Spindles

Accuracy and rigidity deliver 4 to 1 savings!

Material — Super tough rivet set alloy, especially made for Thor.

Previous method — Roughed on single-spindle automatic, straddled to length on turret lathe — both machines running at half speed.

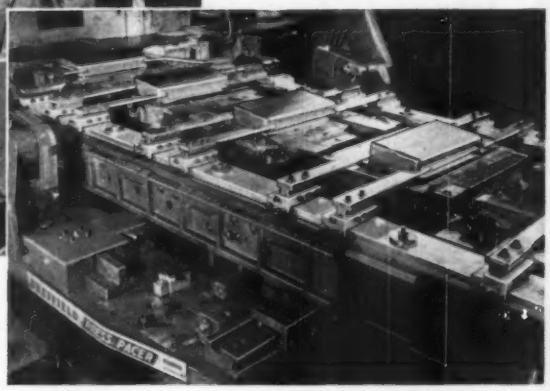
NOW — finished for grinding in single operation on Warner & Swasey 5-Spindle Automatic running at full speed.

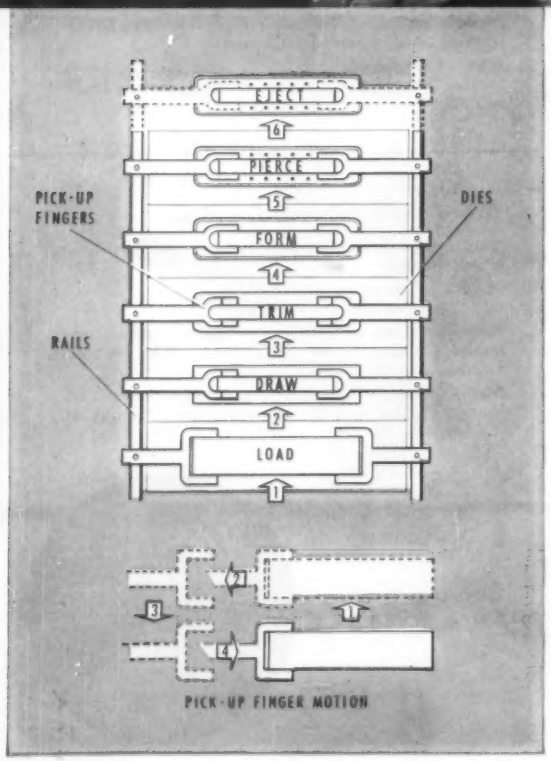
BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

AUTOMATE YOUR PRESS

Automobile oil pan produced from coil stock in six operations on straight side press. Press Pacer automatically transfers stampings from each die station to the next.





The Sheffield Press Pacer is a demountable mechanical transfer device which automates any straight side press with a bed area of 42″ x 72″ or larger and a shut-height of 14″ or more. Moves stampings from one die to the next with each stroke of the ram—or from one press to the next.

The Press Pacer is completely mechanical in operation, being driven by means of a lever arm bolted to the ram. Suitable for all those jobs that cannot be handled on progressive dies.

In one instance, the Press Pacer enabled one press to handle three times the production turned out by six presses. In addition it eliminated work damage caused by moving parts from press to press.

WITHOUT RESTRICTING ITS USE TO ONE PRODUCT BY MEANS OF THE

SHEFFIELD *PRESS PACER*

Press Pacer automatically moves these torque tube flange stampings through 6 die stations on this large press.

COMPLETE FLEXIBILITY

The Press Pacer can be installed in a few hours and if any temporary emergency makes manual feeding imperative, it may be demounted within minutes and the press operated in conventional fashion.

The press may be fed either from front to back or from right to left.

Feed distance between dies can be varied between 8" and 36" on the standard unit.

Stroke adjustment of the standard unit has a range of 12".

Feed fingers and other elements may be readily revised to accommodate product changes.

Automatic loading, unloading and handling are all compatible with Press Pacer operation.

Before deciding on a change in your press equipment, find out how much a Press Pacer would save you.

Send your part prints, press information and production requirements to ***The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 1.***

*Trade-Mark

the **SHEFFIELD** *corporation*

7721

By converting to efficient

LAPOINTE — BROACHING,

The root form on this COMPRESSOR BLADE

is now being machined . . .

Conversion is paying off, in big figures! It seems almost unbelievable, but Lapointe-Broaching has cut the time-cost from 45¢ to 8¢ as compared to the former method of machining this part.

Lapointe designed and built the broaching machine, the broaching fixtures with patented Tip-Down type work tables, and the broaches. Broaching is carried out in four separate operations for several stages of compressor blades, so it is conceivable that the customer was delighted to be able to place the responsibility on Lapointe for the entire broaching operation!

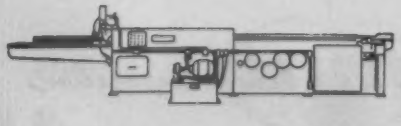
Perhaps a similar saving in cost can be made on some operation you are performing in your own plant. It is worth finding out . . . it costs you nothing to inquire. A Lapointe Field Engineer will be glad to talk with you, and we suggest that you invite him.

THE LAPOINTE MACHINE TOOL COMPANY

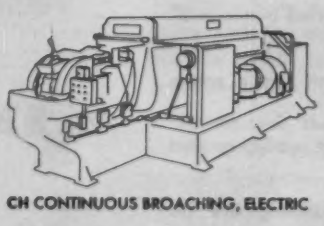
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



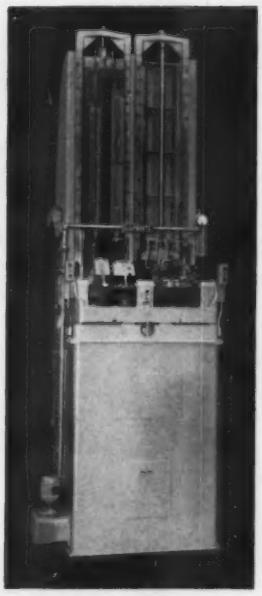
60" STROKE HORIZONTAL, ELECTRIC



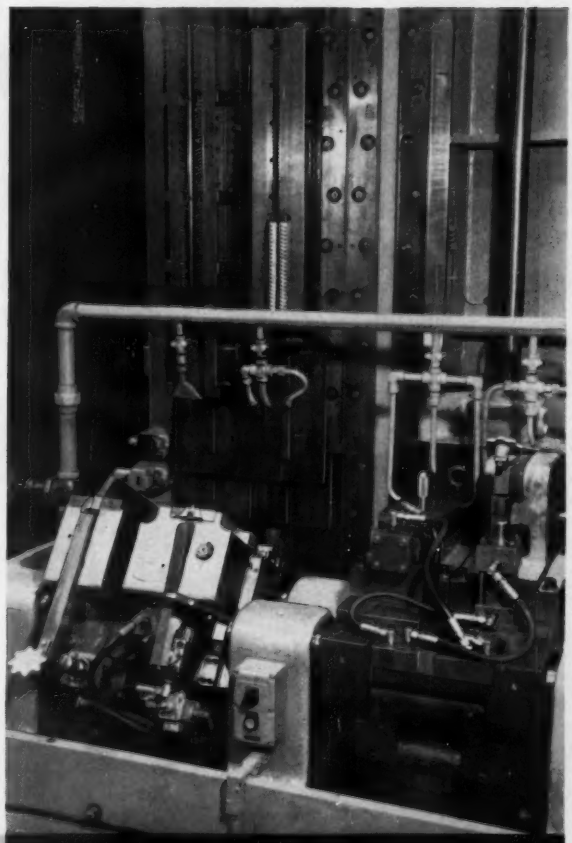
CH CONTINUOUS BROACHING, ELECTRIC

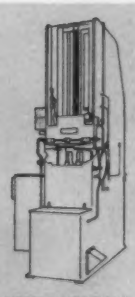
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

. . . at an 82% saving!

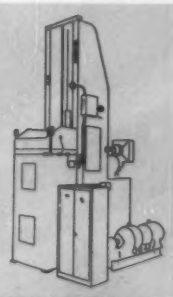


This big 50-hp Double Ram Lapointe Broaching Machine has a 100-inch stroke and is built with Electro-Mechanical Drive. Designed for high production, it has variable speed . . . is exceptionally smooth in operation.

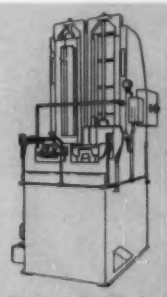




VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC

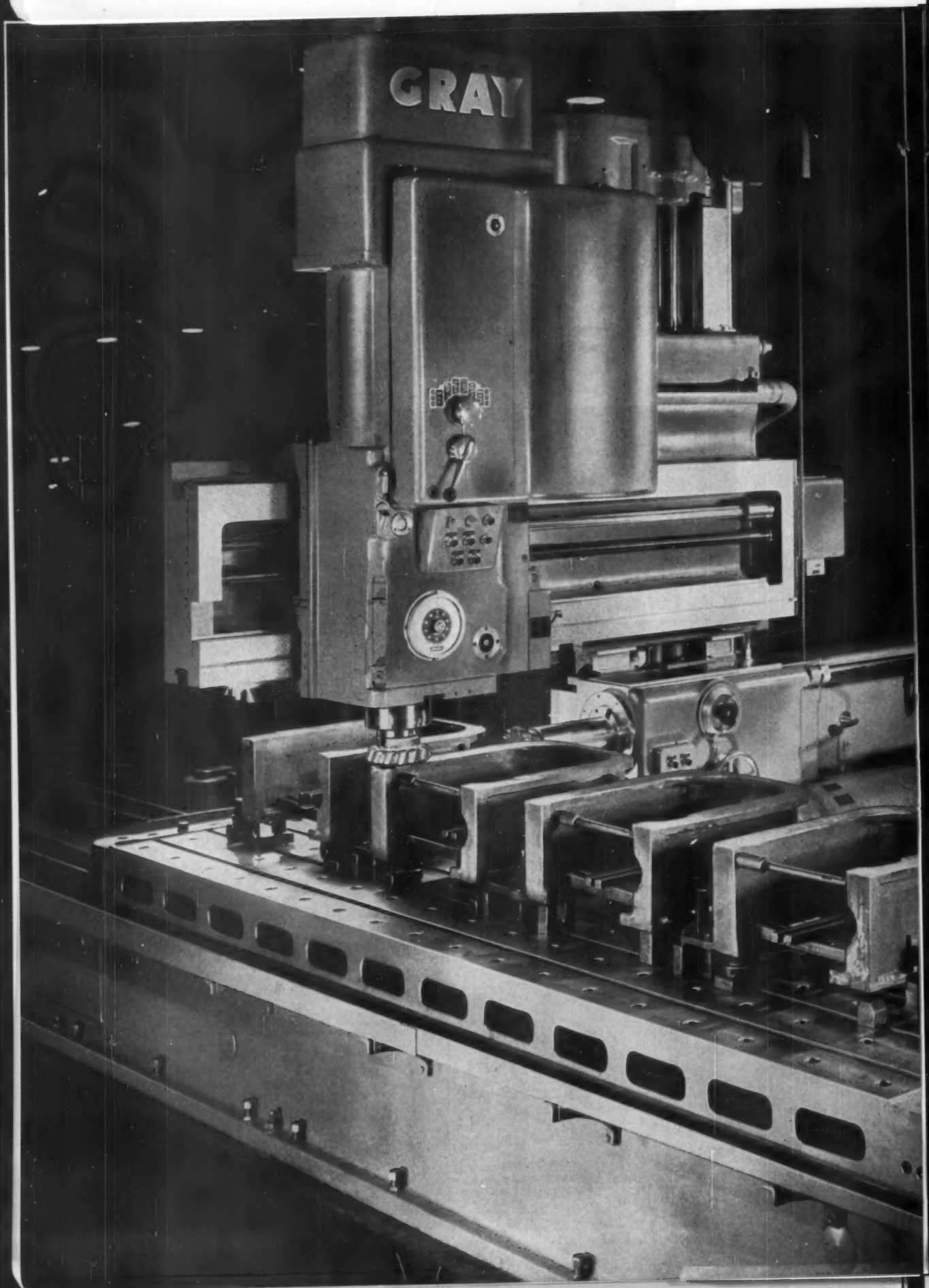


DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING


GRAY

If you're tired of seeing small jobs on your large expensive millers . . .

If you're tired of extra set-ups because your miller has only a single head . . .

If you're tired of whittling away at rugged jobs with low power heads . . .

If you're tired of complicated controls that make your operator a mountain goat . . .

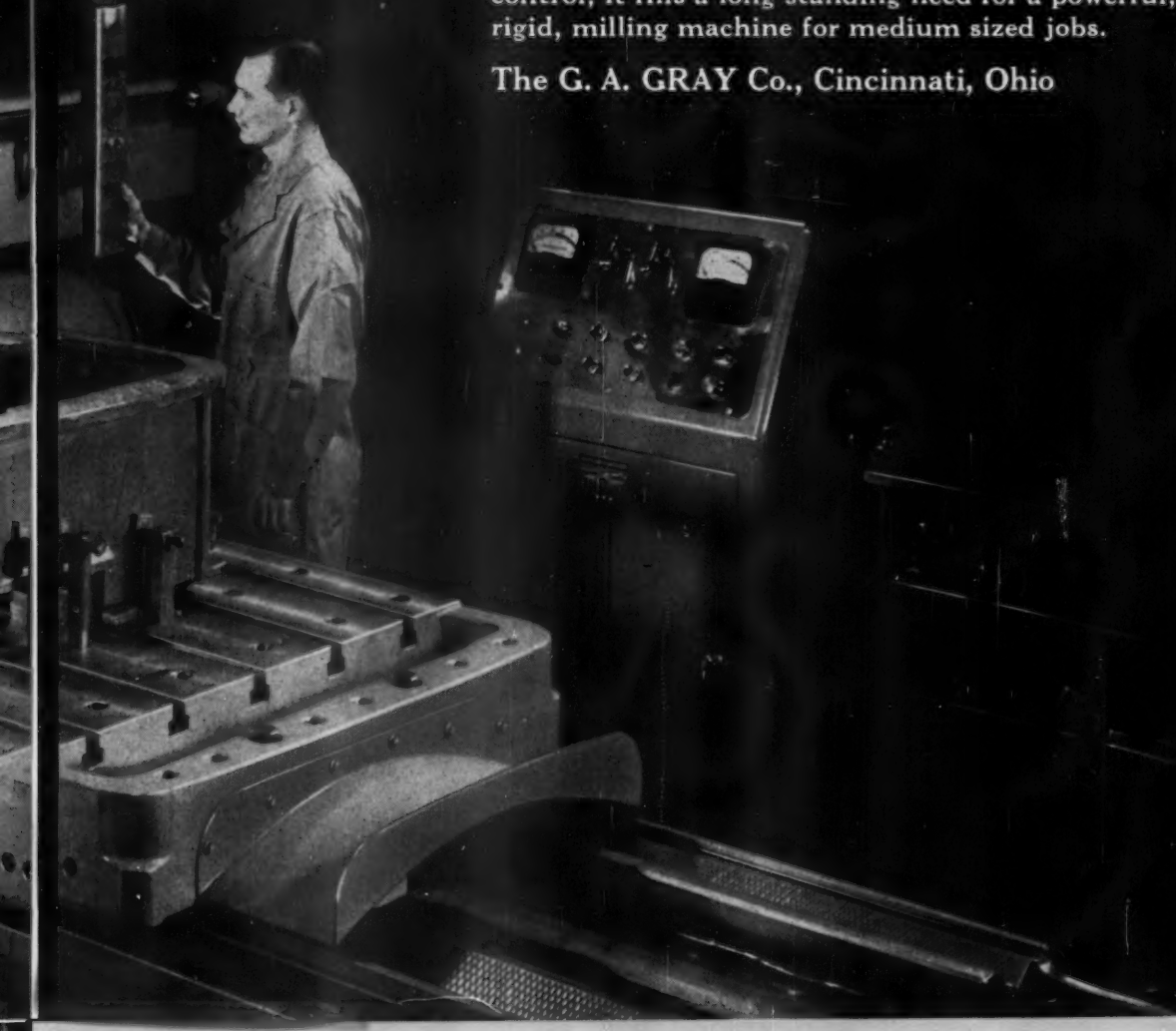
this new

GRAY HANDYMILL

is for you

Built in a wide range of high horsepower sizes, with great variety in head combinations, simplified pendant control, it fills a long standing need for a powerful, rigid, milling machine for medium sized jobs.

The G. A. GRAY Co., Cincinnati, Ohio



Cincinnati Semi-Standard Machines with

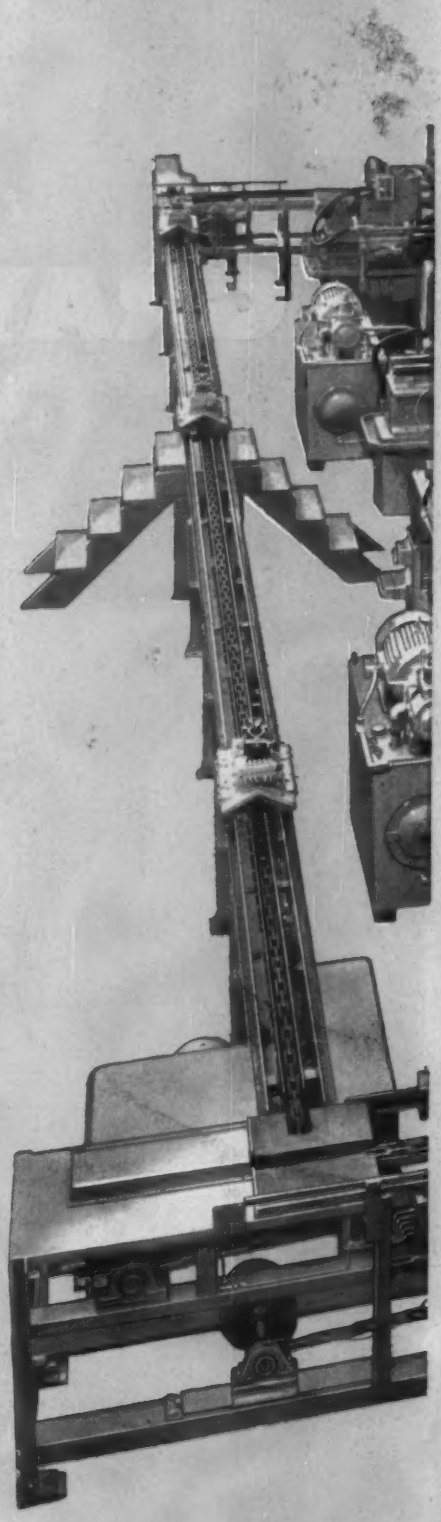
New Snyder Special Transfer Replaces Automation in Processing Forged Steel

Special Features of Snyder Machine No. 55-44

1. Production: 146 pieces per hour.
2. 26 Stations: 28 Operations per piece: 2 milling, 1 sawing, 4 hollow milling, 3 reaming, 1 countersinking, 10 drilling, 5 spotfacing, 1 threading and 1 tapping.
3. Palletized fixtures each carrying two parts.
4. Parts quickly and accurately clamped and located and unclamped by combination torque wrenches and hydraulically operated mechanisms at Stations 1 and 26.
5. Ten individual base segments provide maximum flexibility for future part design changes.
6. Ample room between segments for tool changes and maintenance.
7. Motorized fixture return conveyor with fixture washing unit.
8. Ample chip and coolant facilities.

Standard Features of Snyder Machines

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual leadscrew spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
6. Construction to J.I.C. Standards throughout.
7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.



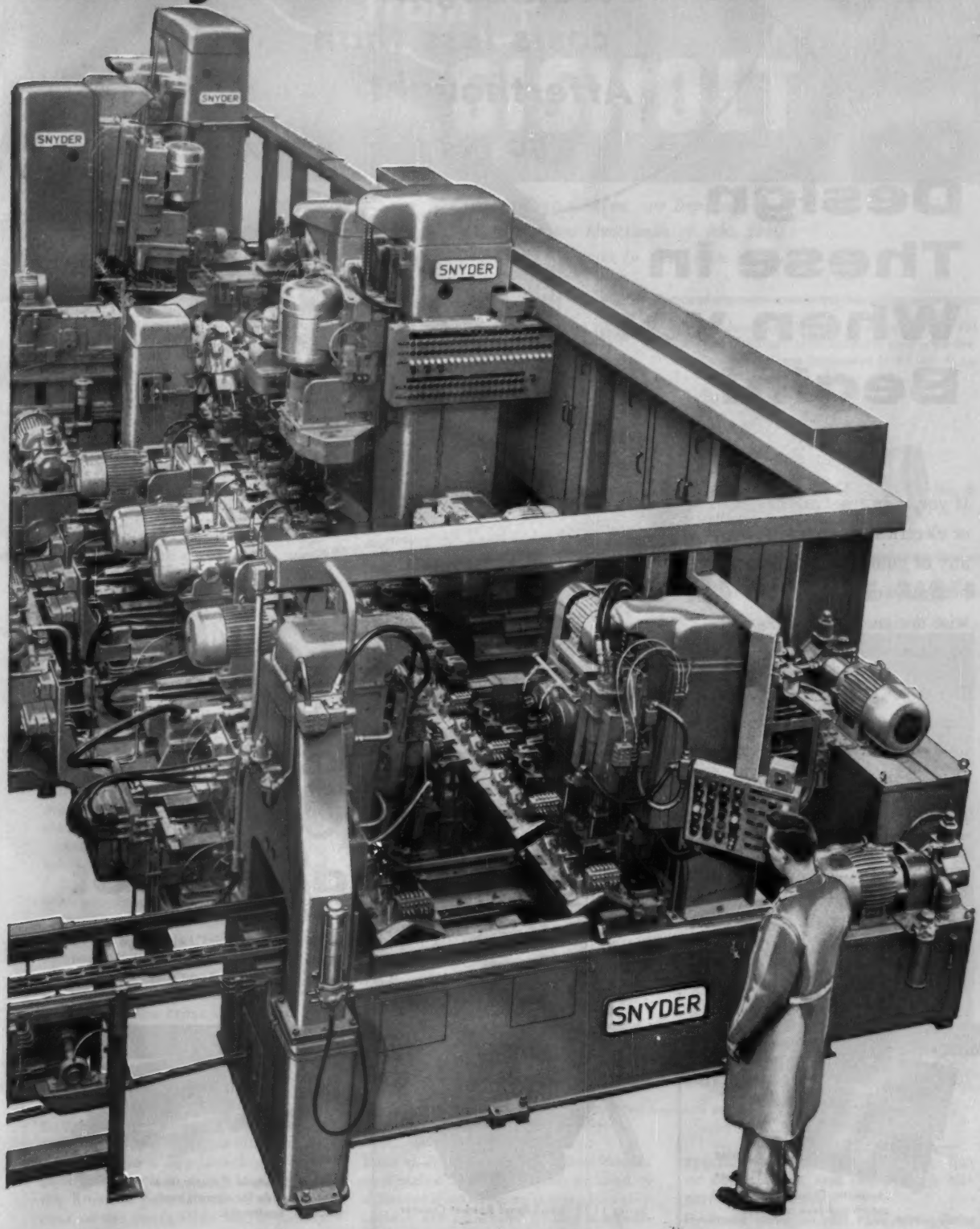
SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

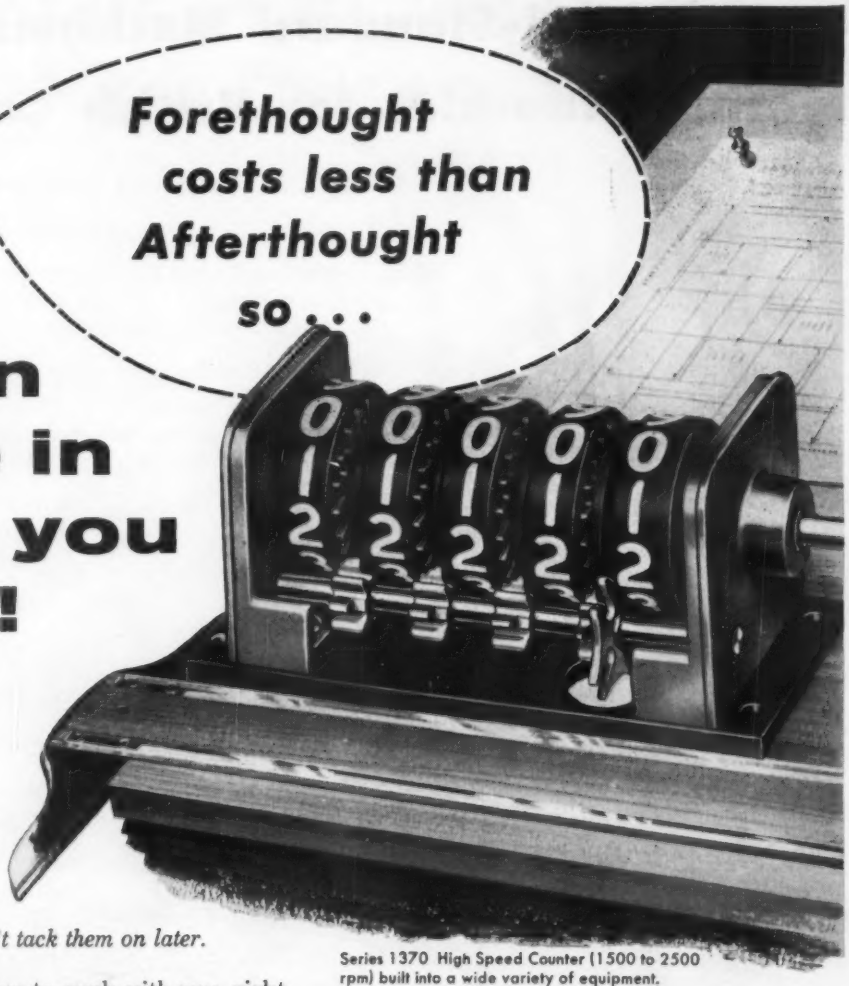
32 Years of Special Machine Tools with Automation

Several Semi-Standard Machines with Steering Knuckles for British Car Builder



Forethought costs less than Afterthought so . . .

Design These in When you Begin!



Series 1370 High Speed Counter (1500 to 2500 rpm) built into a wide variety of equipment.

If you need mechanical or electrical counters in any of your new products, here's a word to the cost-wise designer: *Design them in, when you begin . . . don't tack them on later.*

For if you'll give us a chance to work with you, right from the beginning, chances are we can save you time and money by adapting or modifying a *standard* Veeder-Root Counter to your needs . . where you might get into a costly special job if you went about it alone. What's more, you save time in your engineering, purchasing and assembly departments.

Count on Veeder-Root to help you in every way . . . from design to delivery. Write:

Everyone... Can Count on Veeder-Root

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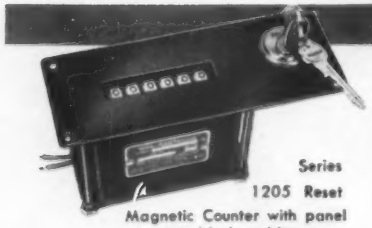
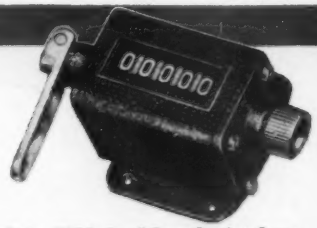


Series 1205 Reset Magnetic Counter with panel mount and lock and key.



Series 1122 Small Reset Ratchet Counter.

Special Longitude Counter, one of many made for aircraft navigational equipment.

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

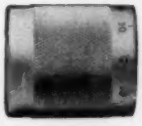
Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

No. 1

No. 2

No. 3

No. 4



No. 5

No. 6

(1) 1/2" Flo-Set Speed Control Valve assembly; (2) valve body section and (3) valve body profile after first operation (1.35 min. f.t.f.); (4) valve stem after first operation (1.30 min. f.t.f.); (5) valve adjusting sleeve (completed in .85 min. f.t.f.); (6) valve collar (completed in .55 min. f.t.f.)

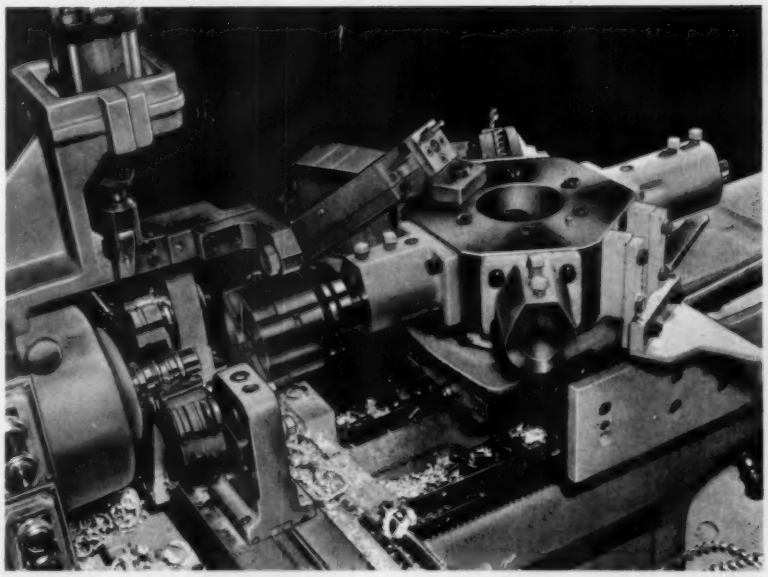
HANNA ENGINEERING CUTS MACHINING TIME 47% ON VALVE PARTS

Automatic cycle on ram type turret lathe reduces costs, boosts production, minimizes attention from the operator

This smart setup reveals how Hanna Engineering Works, Chicago, Ill., has stepped up production to an automatic basis with a variety of Flo-Set Speed Control Valve parts—machined from round and hexagon aluminum bar stock.

Average time reduction over former methods is 47%, using a Gisholt No. 5 Ram Type Turret Lathe equipped with a hydraulic drive unit which controls all machine functions.

Here's a typical fully automatic operating sequence on a ½" size valve body (No. 2 above). A portion of the O.D. is formed by a circular cutter on the front of the cross slide. Hexagon turret tools start drill, finish 2 diameters and a taper in the I.D. with a step drill, form an internal recess and chamfer the I.D. with a turret slide tool actuated from a stop on the cross slide, and thread a portion of the O.D. The bar stock is unchucked, advanced to a headstock-mounted swinging stock stop, re-chucked, and the finished part is cut off from the rear of the cross slide while part of the O.D. on the next workpiece is formed by the same circular cutter. The cycle then repeats. Floor-to-floor time? Just 1.35 minutes.



Tooling close-up for 1/2" valve body. Note overhead swinging stock stop, and circular forming cutters on front and rear of cross slide.

Four different sizes of valve bodies and valve adjusting sleeves, and 3 different sizes of valve stems and valve collars are produced in this manner. Setup time is no longer than that for a standard hand-operated turret lathe. After completing setup, the operator simply removes finished parts, inspects, makes occasional tool changes or adjustments, and inserts new bar stock as required.

Hydraulic drive on ram type turret lathe offers continuous production without operator fatigue...assures high accuracy, consistent quality, maximum tool life through correct speeds and feeds on all operations.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

MODERNIZE FOR PROFITS WITH

REMOVES 520 POUNDS IN ROUGHING THIS PART

Open side steadyrest solves clearance problems

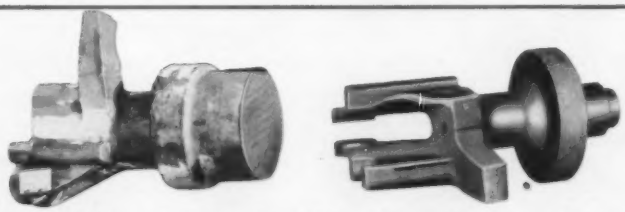
Here's how one manufacturer takes advantage of the sheer power and rigidity of the 5L Saddle Type Turret Lathe, to cut machining costs on difficult parts. This 1190-pound steel turbine control valve casting is typical of what the 5L can do.

A special faceplate fixture—centralized and held in a 32″ 4-jaw independent chuck—is used to locate, clamp and drive the part on the base end. Ample support during machining is assured by a turret-mounted live center and an open side steadyrest, mounted on the rear bedway and supported on a rail on the back of the bed casting. This type of steadyrest does not impede cross slide carriage movements, nor does it obstruct the tooling.

With this setup, all O. D. machining is handled from the compound tool post. Deep cuts are accommodated by special tool holders, giving maximum support to the overhanging tools. Hexagon turret tools re-center, start-drill and drill through the workpiece to complete the operation. In 197 minutes machining time the 5L, using a 75 hp. motor, removes 520 pounds of steel on this job.

Compound tool post on 5L proves rigid enough for heavy cuts, is ready to use for taper-turning operations on other parts.

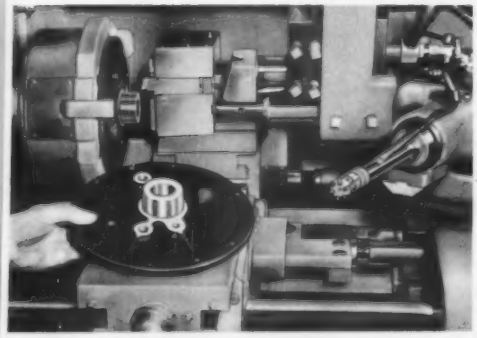
Close-up of square turret tooling and open side steadyrest. Note fixture used to locate, clamp and drive part, which is approximately 36″ long.



Workpiece before and after rough machining. Minimum clearance on deep cuts requires special tool holders on square turret for adequate support during heavy cuts.

SPECIAL TOOL BLOCK SOLVES TRICKY JOB ON 1F FASTERMATIC

Woodruff & Edwards, Inc., uses triple-tooled automatic lathe to increase production

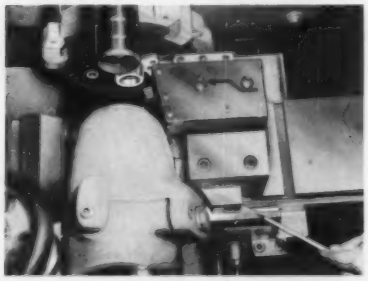


Close-up shows workpiece and two turret faces with tooling which turns, bores, chamfers, faces and reams to complete each part.

Cam-operated rear cross slide tooling from overhead. Arrow indicates path of tool travel.

Check this efficient setup. With it, Woodruff & Edwards, Inc., of Elgin, Illinois, uses the Fastermatic Automatic Turret Lathe cycle—to finish-machine 3 gray iron transmission tops with each complete index of the hexagon turret.

A special drawback fixture holds the workpiece, which is centralized and located on 2 dowel pin holes against the previously machined and ground back face. Special drawback fingers clamp on the O.D.



Identically tooled stations 1, 3 and 5 turn the hub O.D., bore and chamfer while rear cross slide tools face the hub and flange bosses. Stations 2, 4 and 6 finish-ream the bore. The machine stops on stations 2, 4 and 6, the part is unchucked and a new workpiece inserted, and the machining cycle is repeated.

A tapered cam on the rear cross slide permits facing the flange and hub bosses without hitting the drawback fingers gripping on the O.D. The tool block moves in until the tooling clears the fingers; then the tapered angle of the cam moves a sliding tool holder within the block to machine the faces.

Triple-tooled turret on Fastermatic produces 3 finished parts for each index, with f.i.f. time of 1.08 minutes per part.

GISHOLT

LOOK AHEAD... KEEP AHEAD... WITH GISHOLT

time? Just 1.33 minutes.

Simply removes finished parts, in

turret speed and feeds on an operational

THE GISHOLT MASTERLINE

GISHOLT

TIME-SAVING IDEAS

CALIFORNIA PELLET MILL CO. CUTS LARGE PART CHANGE-OVER

Simplifies operator's job with adjustable slides, special tool blocks, clamp-on tools on No. 24

You'll spot smart planning in the way a wide variety of steel pellet mill die forgings—ranging up to 20¾" diam.—is machined by California Pellet Mill Co. at San Francisco, Calif., and Crawfordsville, Ind.

Rugged Gisholt MASTERLINE No. 24 Automatic Production Lathes perform 4 different operations on each workpiece. Work is held in a 28", 3-jaw air chuck. Plain chuck jaws hold the largest part; inserts and adjustable jacks add the flexibility to handle smaller parts.

Change-over from one operation to the other is fast, simple and low in cost. Front and rear tool blocks are quickly adjusted. Tool shanks are mounted in slots cut in the tool blocks. Longitudinal slots in the shanks permit fast in-or-out screw adjustment. To handle the required surfaces, the operator adds or removes necessary tool bits. For finish boring, a hydraulically operated off-center pivoting tool relief eliminates tool tracks. The 2-speed motor provides desired low speed for the deep grooving cuts. A load meter on the headstock signals tool changes by indicating power increase requirements.

Finishing operation on 20¾" diam. part. Hydraulic cylinder at rear of front slide operates linkage to pivot boring tool off-center before withdrawal, eliminating tool tracks.

No. 24 completely roughs and finishes each part in 4 operations: turning O.D., boring I.D., facing both ends, grooving and forming. Total f.t.f. time on 20¾" diam. part is only 24 minutes.

INDEXING TURNTABLE HOLDS IDLE TIME TO ONLY 18 SECONDS

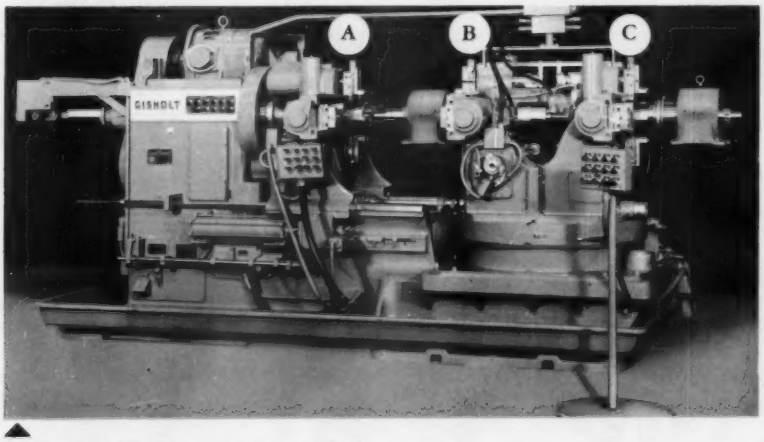
Permits loading and unloading on Simplimatic while new part is being machined

With this well-planned setup, the manufacturer is handling over 30 different sizes of electric motor frames. Three identical groups of tools are used, mounted on vertical heads A, B and C. Each group includes an independent rough and finish facing slide, and a rough and finish boring head.

Heads B and C carry expanding mandrels to permit chucking in the I.D. They are mounted on an indexing turntable, to permit loading and unloading operations at one end while machining is performed at the other. Head A traverses toward the turntable, with a special spindle arbor mating with the mandrel to drive the part. A clutch at the base of head A engages a clutch at the base of the turntable, actuating the tooling, simultaneously machining the work at both ends. Head A reverse-traverses, disengages all driving clutches, and clears the turntable to permit indexing a new part into machining position.

Change-over is fast. Tool slides are repositioned and expanding mandrels changed. Dial indicators speed tool setting.

5,000-lb. turntable indexes and head A reverse-traverses and returns in 18 seconds—only idle time in entire operation. F.t.f. times range from .85 min. on 8¾" O.D. workpieces to 2.34 minutes on 12" O.D.



Indexing turntable shows workpieces on both ends. Note head A retracted to permit indexing new piece into position.

Three different workpiece sizes, showing range handled with this setup.

TALK TO GISHOLT ABOUT MACHINE TOOL LEASING

GISHOLT

MASTERLINE
GISHOLT SINCE 1887

TIME-SAVING IDEAS

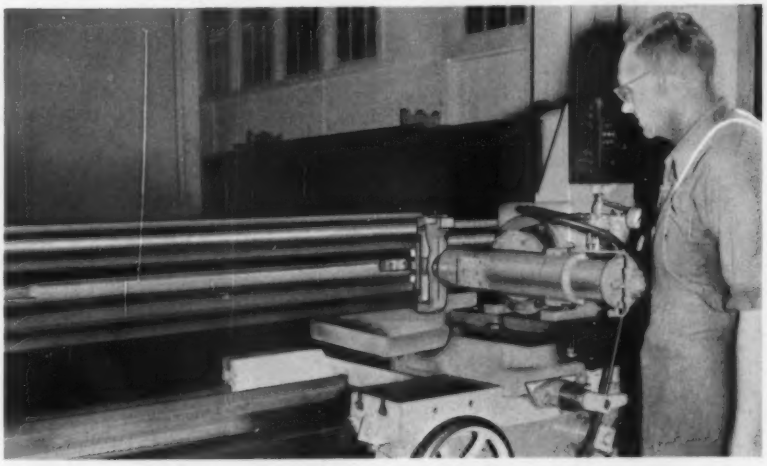
ERIE ORDNANCE SUPERFINISHES 155 MM. GUN TUBES FOR LONGER LIFE

Mounts inexpensive attachment on lathe to save time, cut costs

Here's an interesting job that may point the way to better quality at less cost in your own finishing operations.

To prepare new and reconditioned artillery pieces for service, Erie Ordnance Plant, LaCarne, Ohio, frequently has to refinish galled or scored gun tube O.D.'s. Often the tubes meet drawing requirements, but still carry toolmarks perpendicular to direction of recoil—causing a filing action on the brass recoil liners.

To reduce refinishing time and obtain an improved surface finish, Erie Ordnance mounted a Gisholt No. 4 Superfinishing attachment on a lathe with enough capacity to handle all gun tube sizes. A typical part is the 155 mm. tube shown here, 12½" diam. by 64" long, with a smaller 10" diam. and a 64" length with a keyway. A special 3-stone holder permits Superfinishing over the keyways without difficulty.



Special 3-stone holder used to Superfinish over keyway on 155 mm. gun tube.

With previous methods, up to 2 days were required for a single tube. With the modern Superfinishing attachment, 15 to 16 tubes are completed in two 8-hour shifts, varying slightly depending on surface conditions. All sizes are handled on same attachment by changing stone holders and adjusting oscillation rates and stone pressures.

Superfinisher attachment reduces surface finish readings from as high as 50-60 micro-inches—including deep marks from galling and scoring—down to 8-12 micro-inches in minimum f.t.f. time.

BALANCES 77 FLYWHEELS AN HOUR, INCLUDING CORRECTION AND INSPECTION

Gisholt 1SV1 locates, measures, corrects and inspects for unbalance in single handling

Close-up of workpiece on adapter and integral correction equipment. Note that the correction radius may be easily changed by turning handwheel behind workpiece. This feature permits handling many different part sizes with minimum change-over time.

The trick here is to get high-production balancing on large-diameter, narrow-width parts requiring correction in a single plane. A Gisholt 1SV1 Vertical Balancer does the job easily.

The workpiece—an automatic transmission flywheel—is placed on a special adapter and rotated. The Direct Reading Amount Meter and strobe light, which indicates the angle of the unbalance, are mounted in one housing, permitting the operator to observe the angle and amount of unbalance simultaneously in the same visual field. To correct for unbalance he stops the spindle and positions the part for correction at the observed angle. He then lowers the drill, which actuates an air-operated thrust device (visible on the left of the workpiece) to support during the correction drilling operation.

Drilling to the precise correction depth is made easy by calibrating the Direct Reading Amount Meter. The operator simply matches the reading with a simple scale on the drill press. Unbalance is usually corrected by drilling 3 holes or less, promoting the production of 77 parts an hour at 80% efficiency.

Correction equipment mounted integrally with Gisholt Balancer permits completing all operations in single handling.

DYNETRIC BALANCERS GISHOLT

No. 3-457
678

GISHOLT

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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GISHOLT MACHINE COMPANY

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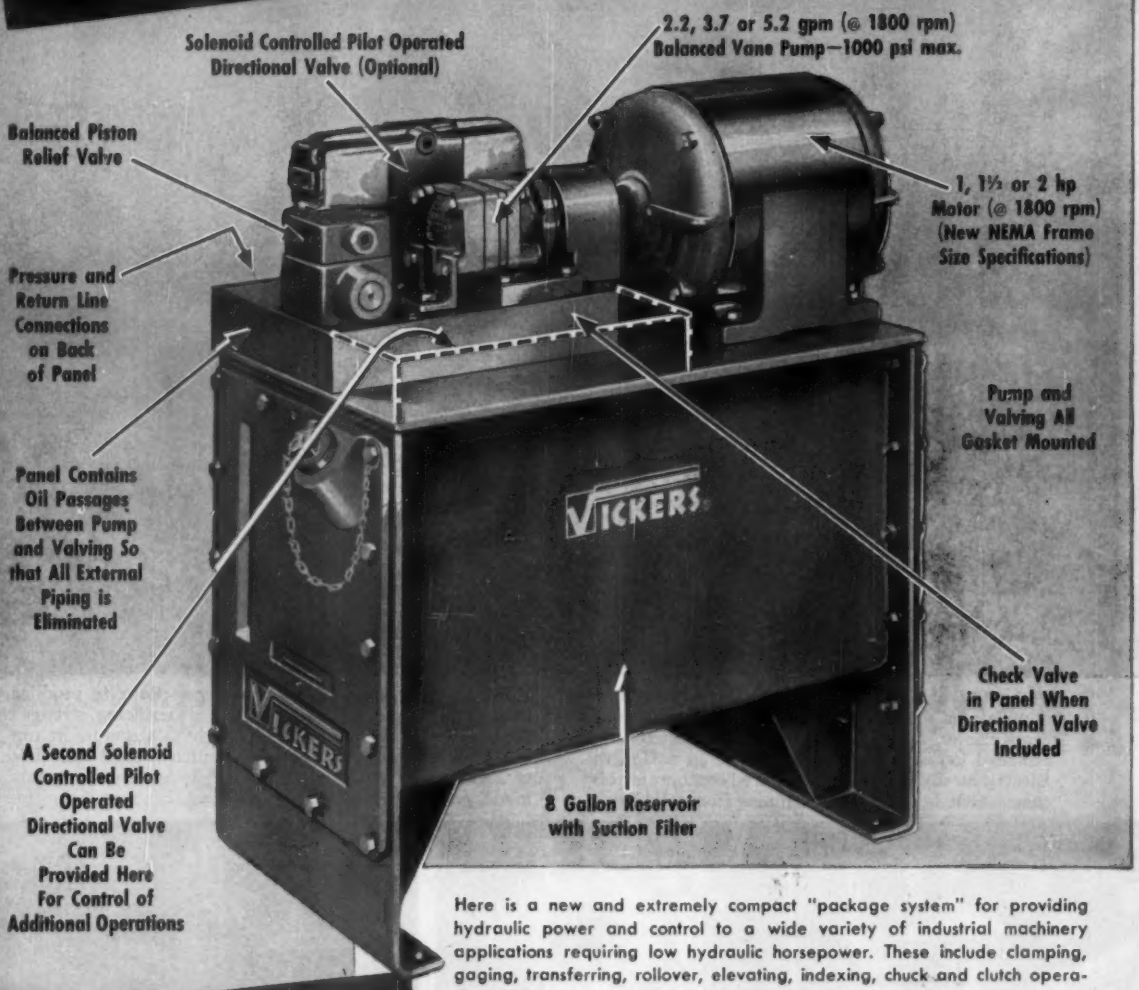
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

A NEW IDEA . . . in hydraulic power and control systems


Solenoid Controlled Pilot Operated Directional Valve (Optional)
2.2, 3.7 or 5.2 gpm (@ 1800 rpm) Balanced Vane Pump—1000 psi max.
Balanced Piston Relief Valve
1, 1½ or 2 hp Motor (@ 1800 rpm) (New NEMA Frame Size Specifications)
Pressure and Return Line Connections on Back of Panel
Pump and Valving All Gasket Mounted
Panel Contains Oil Passages Between Pump and Valving So that All External Piping is Eliminated
Check Valve in Panel When Directional Valve Included
A Second Solenoid Controlled Pilot Operated Directional Valve Can Be Provided Here For Control of Additional Operations
8 Gallon Reservoir with Suction Filter
VICKERS

VICKERS®
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HYDRAULIC
PIPELESS
POWER PACKAGE*

Here is a new and extremely compact "package system" for providing hydraulic power and control to a wide variety of industrial machinery applications requiring low hydraulic horsepower. These include clamping, gaging, transferring, rollover, elevating, indexing, chuck and clutch operations, etc.

Note the many features indicated on the photograph above. The result is improved and simplified hydraulic design . . . also reduced installation and maintenance costs. This "package system" has great flexibility . . . is available in a wide variety of combinations of standard components assembled to suit individual requirements. Pretested and ready for immediate operation, it has also the advantage of undivided Vickers responsibility. For further information, ask for installation drawings 178706-8.

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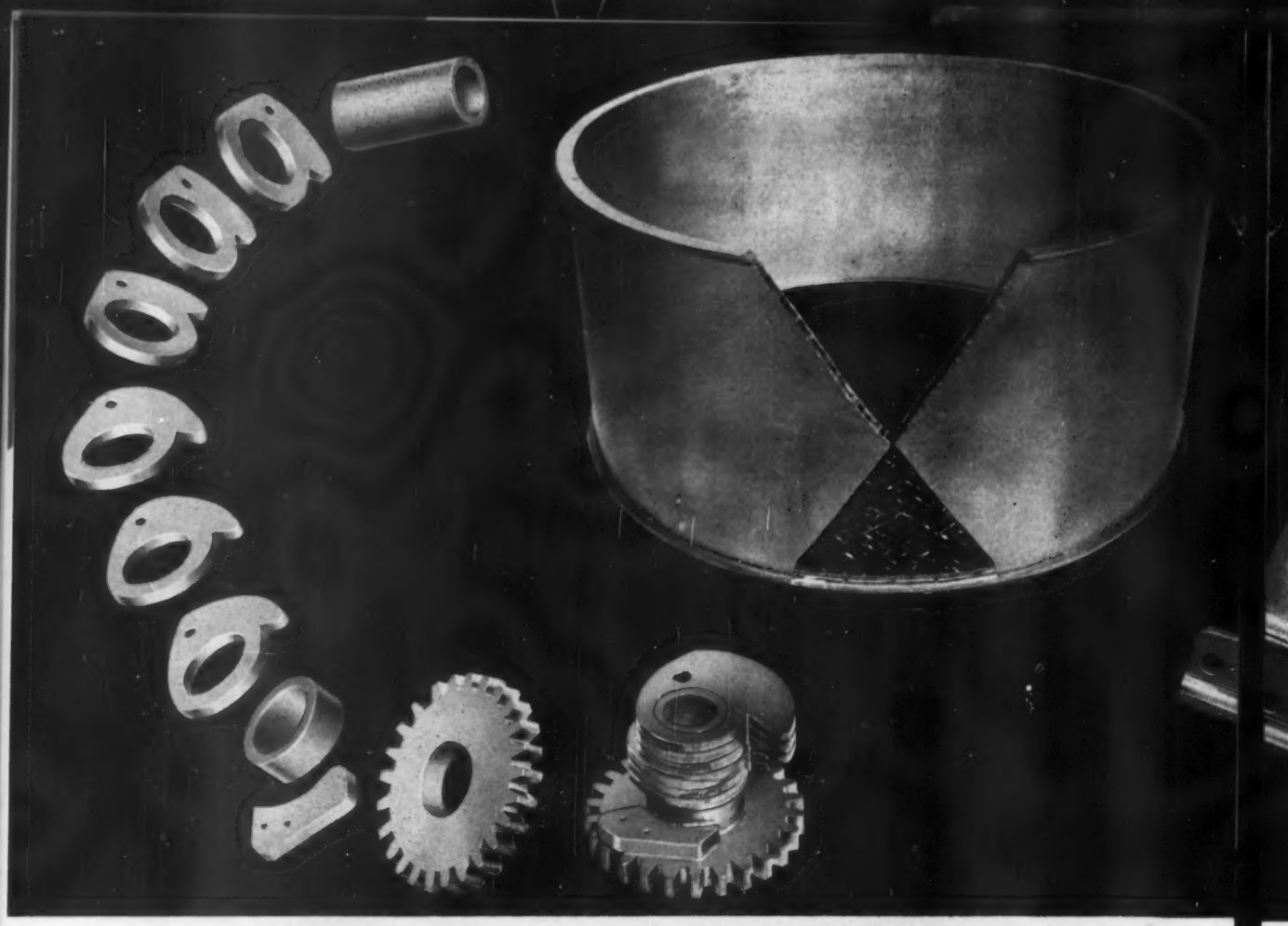
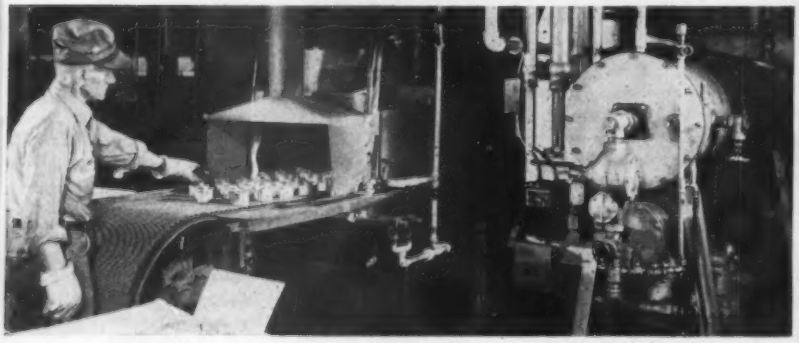
*These "package systems" supplement the Vickers line of standard hydraulic power units.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

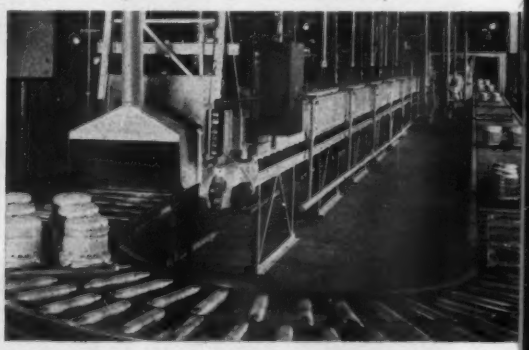


Versatility of furnace brazing is shown in these applications. Complex assemblies like the cam-and-gear cluster on the left can be fabricated from punched laminations brazed securely in a General Electric mesh-belt furnace. Required contours are obtained without expensive machining from solid stock.

Thin sections can be joined to heavy sections to produce light-weight rigid structures without sacrificing strength or inducing local distortion. Honeycomb structure at top center weighs about one fourth as much as solid assembly of same rigidity. It is typical of design improvements made possible by brazing in General Electric furnaces.



Continuous production of small parts in this General Electric mesh-belt furnace is carried out by loading assemblies directly on the belt. Protective atmosphere equipment, at right, eliminates need for flux in most cases, keeps parts clean enough to be passed directly from the furnace, without cleaning or pickling.



Automatic charging, and discharging and return conveyors of this General Electric roller-hearth furnace make it almost self-operating, reduces handling costs. G-E roller-hearth furnaces handle heavy assemblies and are well suited for automated lines.

GENERAL ELECTRIC SELLS
A COMPLETE LINE OF
HEAT PROCESSING EQUIPMENT

FURNACES • METAL-SHEATH • INDUCTION

Box | Cylindrical Pit | Roller Hearth | Elevator

Produce Complex Assemblies Faster and at Less Cost with General Electric Furnace Brazing

Two or more metals can be joined, as in the bellows housing shown above. The steel flange is furnace-brazed to a brass shell, using preplaced rings of silver brazing alloy. The desirable qualities of each metal are retained.

Development work is done in this General Electric box furnace, which could also be used for job-lot production. Low in first cost, General Electric box furnaces need little maintenance.

General Electric furnace brazing speeds production of really "tough" assemblies—and often does it at less cost than you can do it by your present methods.

For example, here are three types of work where you can improve production with furnace brazing.

You can make complex assemblies from already formed components, and save both material and machine costs.

You can make assemblies of two or more different alloys without changing the desirable characteristics of either.

You can join thin sections to heavy sections without sacrificing strength or inducing local distortion.

These characteristics of furnace brazing can be used in a number of widely different production setups. And General Electric's complete line of furnaces and associated equipment lets you pick the proper furnace to introduce furnace brazing into your particular setup—economically, efficiently.

Cost reductions are typical with furnace brazing because labor content per assembly goes down while output goes up. Waste is reduced since assemblies can be built up of components instead of being machined from solid stock. Uniformity of results frequently leads to reduced inspection costs.

Improved products are the rule with furnace brazing. Life of assemblies is increased because joints have high strength, resist vibration and impact, and are uniformly tight. Assemblies show little or no distortion, since they are free from localized strains. They present a good finished appearance without afterwork because the brazing alloy forms neat fillets. Also protective furnace atmospheres eliminate formation of oxides and do away with the need for flux in most cases.

Increased production over other joining methods is possible, since many joints can be brazed simultaneously. Furnace brazing is adaptable to continuous production, with increasing output.

For a careful analysis of your furnace brazing needs call your General Electric Heating Specialist. Ask him to show you how you can benefit by using furnace brazing. You can reach him at your local General Electric Apparatus Sales Office. If you prefer, send in coupon below for bulletins describing furnace brazing operations and equipment.

GENERAL ELECTRIC

FREE PROCESS BULLETINS

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- ☐ Protective Atmospheres, GEA-5907

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- ☐ How and Where to Use Furnace Brazing, GEA-3193
- ☐ Electric Furnace Brazing, GER-106
- ☐ Furnace Brazing of Machine Parts, GER-339

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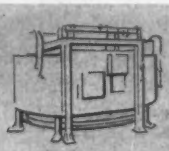
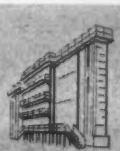
Mesh Belt



Rotary Hearth



Tower

Cylindrical Bell

Metal-sheath

Electronic Induction

Know a better name than "Spade"?

(It certainly isn't "Heavy-Duty, Super-Powered, Raised-in-the-Sand Trowel"!)

Same goes for lathes! Why call a lathe a 16″ machine, when it may swing 18½″ over the bed and only 12½″ over the cross slide—more or less? Especially when most lathe types are used largely for between center work? Monarch is proud to be a part of the Lathe Group that has performed a real service to lathe buyers by proposing the commonsense, informative four-digit designation system. And *we're* going even further. Henceforth every Monarch model designation on new lathes will give you a complete description at a glance!

The Four-Digit System

This is simplicity itself. The first two digits reveal swing or clearance over bed and carriage wings. Second two digits, swing over cross slide on the basic machine. A reference to the chart shows how immediately informative this is.

Raising—and Heavy Duty Information

Now, you know where you stand with Monarch—as in contrast with such practices as calling a basic 20″ machine a 20″ heavy duty, then raising it to 25″ and calling the raised model a 25″ standard.

All Monarch lathes designated "Heavy Duty" are engineered heavy duty machines—and the specifications reveal the weight, power, and capacity to justify the term. Where engineered raises in the sand are involved, the basic designation will be used, followed by a dash and the raised clearance. For example, the first raise of our Model 4025 Heavy Duty will be expressed as Model 4025-31 Heavy Duty. Simple! Clear! Understandable! Factual!

The "Engine" vs "Toolmaker's" Doubletalk

The fact that these terms still exist at all is a tribute to the force of habit. For years, we've only made one grade of lathe—the best within our power. Every machine has the utmost in built-in precision and production because the close manufacturing limits of today are equal to and often surpass the toolroom limits of yesterday, while high labor rates make it essential that toolroom operations be placed on the highest possible productive basis. It is true that a lathe for toolroom use must, as a rule, have more flexibility than one for manufacturing purposes. So, on many models, we furnish a standard complement of additional equipment. Machines with such equipment differences are designated with the suffix "T". Model 1610 becomes Model 1610-T. As for the word "Engine" applied to a lathe, it lost meaning years ago. Let's bury it!

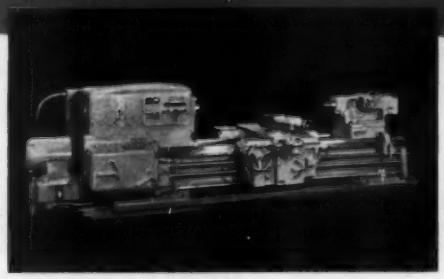
In a Nutshell...

Now you know how to appraise the swing capacity of every Monarch Lathe at a glance. We hope the day will come soon when the same nomenclature will apply to all lathes made. Then nobody will have to dig for the facts—The Monarch Machine Tool Company, Sidney, Ohio.

SIZE DESIGNATIONS

Machine	New Four-Digit System	Outmoded Size Designations
Series 62 Preselector Dyna-Shift	1610	13″ Engine
	1610-13	13″ Raised Engine
	2013	16″ Engine
	2013-16	16″ Raised Engine
	2516	20″ Engine
	2516-19	20″ Raised Engine
Series 80 Heavy Duty Dyna-Shift	2516	20″ Heavy Duty Engine
	2516-20	20″ Heavy Duty Raised Engine
	3220	25″ Heavy Duty Engine
	3220-24	25″ Heavy Duty Raised Engine
	3220-28	25″ Heavy Duty Raised Engine
Series 90 Heavy Duty Dyna-Shift	4025	32″ Heavy Duty Engine
	4025-31	32″ Heavy Duty Raised Engine
	4025-36	32″ Heavy Duty Raised Engine

NOTE—Older models, namely Model EE Manufacturing and Toolmaker's, Series EE-Model 1000, Series 61 Engine and Toolmaker's Lathes and Models M, N, and NN Heavy Duty Engine Lathes will retain old designations because of long-established user acceptance. The suffix "T" after the following model designations denotes inclusion of additional equipment usually required for toolroom use—1610, 1610-13, 2013, 2013-16, 2516, 2516-19.



For Example:

Monarch Series 90 Heavy Duty Dyna-Shift—Model 4025-31
Basic Clearance over Bed and Carriage Wings—40″
Basic Swing over Cross Slide—25″
Raised Swing over Cross Slide—31″

Monarch
TURNING MACHINES
ACCURACY • ECONOMY • LONG LIFE
FOR A GOOD TURN FASTER . . . TURN TO MONARCH

NOW AVAILABLE COAST TO COAST FROM WAREHOUSE STOCKS

USS FREMAX

the free-machining plate steel that

- cuts machining costs
- prolongs tool life
- speeds output
- gives smooth surface finish

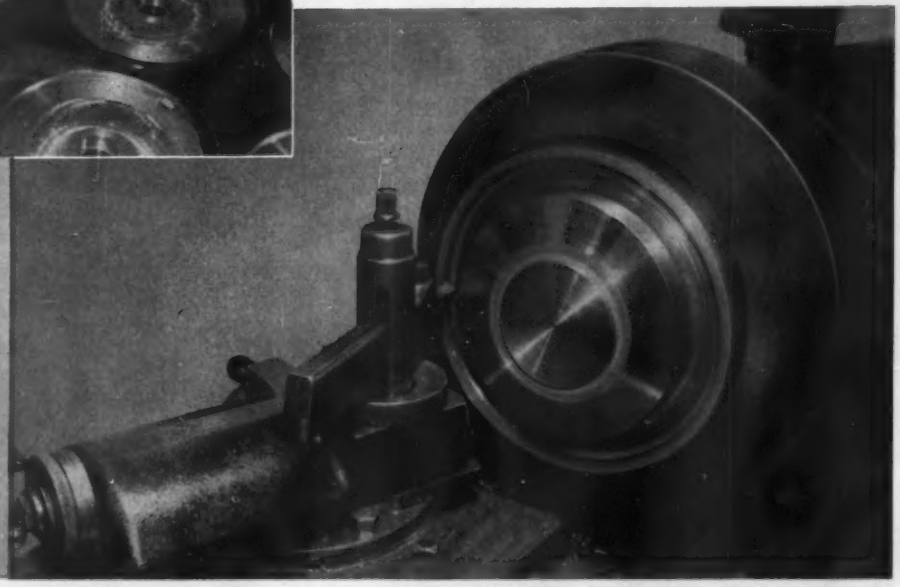
USS FREMAX is a low carbon, high sulphur, free-machining plate steel that is far superior to ordinary carbon plate steels for such machining operations as cutting, drilling, knurling, milling, broaching, shaping, turning and threading. *Tests show that* FREMAX *can be machined at cutting speeds 100 to 200% greater than SAE 1020 plate steel while still maintaining the same tool life,* thus enabling you to obtain higher production and lower cost per item.

You will find USS FREMAX ideally suitable for dies and molds where a smooth, unblemished surface finish is a prime factor. FREMAX is easy to weld, enabling you to make strong, sound, tight welded joints.

We can give you immediate delivery on USS FREMAX plate steel. Just phone, wire or write us at Chicago, or contact any of our warehouses.

Prompt Delivery

from your nearest warehouse



This core for a rubber brake seal mold shows the fine surface finish obtainable on USS FREMAX plate steel.

U. S. STEEL SUPPLY

DIVISION

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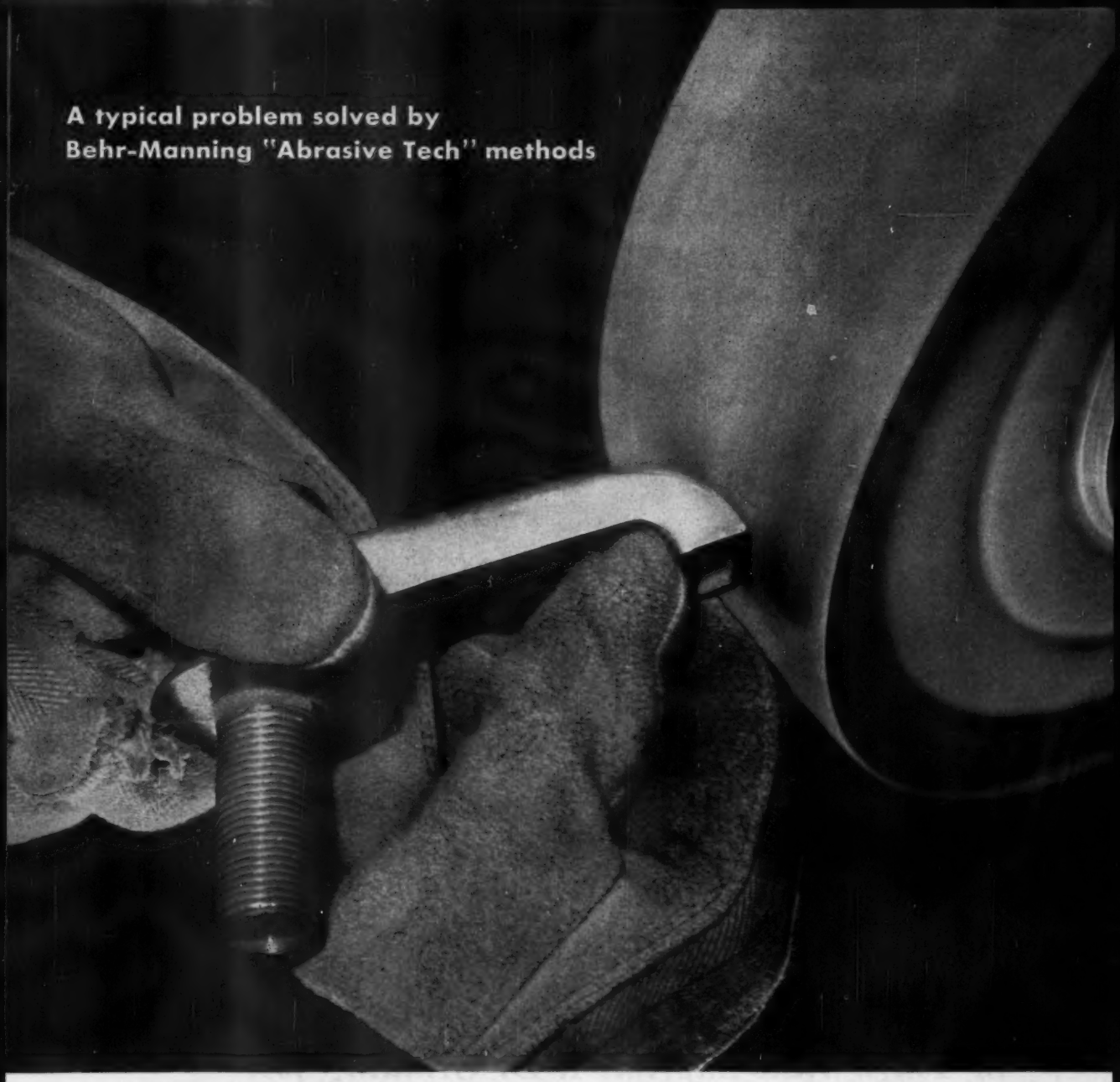

8 steps in finishing were eliminated by using abrasive belts to rough and polish cast-brass faucets prior to plating. Polishing, for example, was faster and smoother with a 3-in. x 90-in. Lightning Metalite Cloth belt, grit 240, running at 9000 sfpm over a 14-in. stitched buff contact roll on a Crown Rheostat Polishing Lathe. The belt is lubricated with a light grease stick. Time, labor, and material costs have all been cut by this "Abrasive Tech" method. Perhaps Behr-Manning technical service may provide similar benefits for your production.

Very often a Behr-Manning methods engineer can provide a helping hand with different finishing problems. Just call the nearest Behr-Manning office for a date. There are 17 well-equipped "Abrasive Tech" Methods Rooms, available for problem-solving, or helping finishers brush up on new techniques: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, Teterboro, Camden, San Francisco, Seattle, St. Louis, and Brantford, Canada. Main office and plant: Troy, N. Y. For Export: Norton Behr-Manning Overseas, Inc., New Rochelle, N. Y., U.S.A.

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BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes
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BEHR-MANNING ®

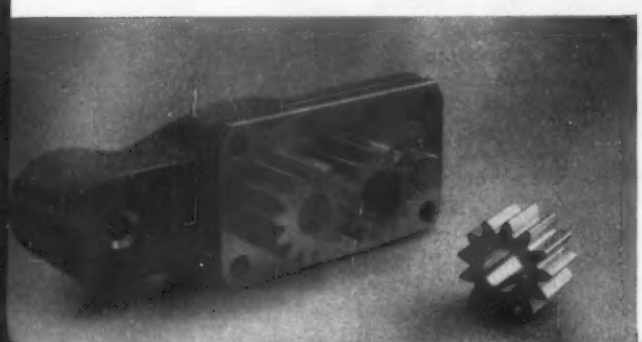
A GRINDING PROGRESS REPORT

Extra Fine Grit Silicon Carbide Succeeds in Tough Vasco Supreme I. D. Grinding Job.

One basic fact affects wheel selection for all internal grinding: Only light infeed pressure is possible. With the wheel mounted at the end of a long, slender spindle, too much pressure would cause deflection and distort the hole. The relatively large area of grinding contact further reduces the infeed pressure. Also, small wheels and high spindle speeds mean limited driving power.

On extremely hard, tough metals, the problem of finding the wheel to grind efficiently becomes critical. For harder metals it is usual to use softer grinding wheels, but there is a limit. It comes when the wheel is so soft it will not hold shape, requires frequent dressing for re-truing, and wears out quickly.

W. H. Nichols Co., Waltham, Mass., faced a challenging problem in production grinding the I.D. of spur pump gears made of Vasco Supreme, Neatro, or Ohio Air Die steels hardened to 58 - 64 Rockwell C.



Gear pumps made for the synthetic yarns industry by W. H. Nichols Co., require hard, abrasion-resistant steels.

W. H. Nichols Co. Foremen Rousseau and Burns, and Abrasive Engineer Pete Wilson checked closely on production, quality, and wheel performance with operator, during trials.

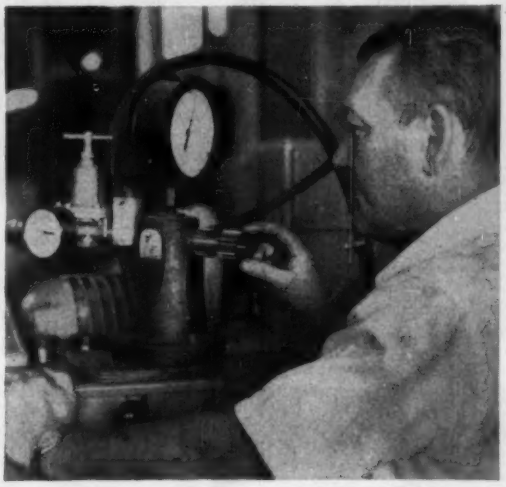
There, Bay State Distributor Engineer Pete Wilson worked closely with "Skipper" Burns, Production Foreman, and Hector Rousseau, Grinding Foreman. First, they reasoned that for these materials of high carbide content, Silicon Carbide abrasive would penetrate better and give cleaner cutting than the Aluminum Oxide being used.

They also reasoned that more cutting action would occur if more and smaller abrasive grains were cutting into this hard material. Instead of the normal grit sizes of 80 - 90, they tried grits ranging from 150 to 240.

How right they were is proved daily, in W. H. Nichols' production figures and grinding costs. Using 240 grit Silicon Carbide on the Vasco Supreme, and 150 grit on the Neatro and Ohio Air Die steels, their grinding wheels now have three times the old life. Dressing, which formerly removed .008" of the wheel each cycle, now takes only .001", just enough to keep the wheel sharp. With the extra fine grit sizes, the wheels grind more efficiently and hold shape excellently. Production schedules are being met with gears of fine dimensional accuracy, 50 or more being completed per wheel.

Top ranking abrasive engineering skills like those used in this case are available to you for your grinding. Contact your local Bay State distributor, any branch office, or the Bay State Abrasive Products Co., Westboro, Massachusetts.

Improved finish (5 micro-inch) from the finer grits also gives greater accuracy in the air-gaging.



Branch Offices are located in Bristol, Conn.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Pittsburgh, Pa.; with distributors in all principal cities.

In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ont.

BAY STATE ®
WHEELS of PROGRESS

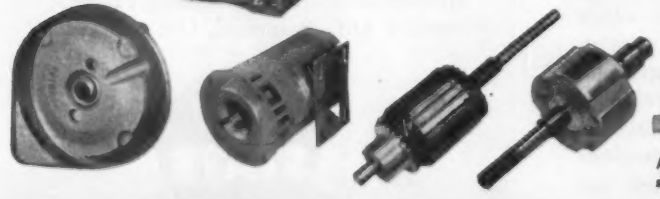
hard, abrasion-resistant steels.

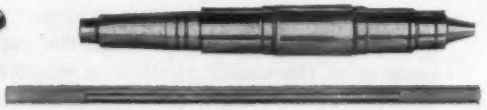
How to improve MACHINING METHODS FOR with Sundstrand "Engineered Production"

Special 14-station Sundstrand transfer machine for ruff and finish milling, boring, drilling, and tapping various sizes and types of motor frames.

● Here are seven interesting examples of Sundstrand "Engineered Production" as applied to the manufacturing of electric motors. These motor components vary in size and operations required. Each is machined on Sundstrand equipment with the method best suited to the production requirements of the plant in which they are installed. Greater output, improved quality and lower unit costs are the direct results of applying Sundstrand "Engineered Production" to your machining problems.

If you are manufacturing electric motors of any type, the practical experience of Sundstrand engineers on numerous jobs similar to yours is sure to pay off in improved machining methods. Either your nearby Sundstrand field office or the engineering department at the home office will be glad to discuss your manufacturing problems without obligation.

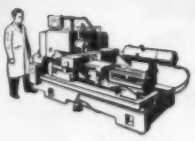


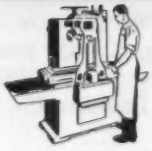


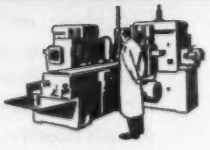
Motor frames, commutator assemblies, armature assemblies, rotors, shafts, etc., all machined on Sundstrand equipment.

SUNDSTRAND "Engineered Production" Service* *REG. U.S. PAT. OFF.

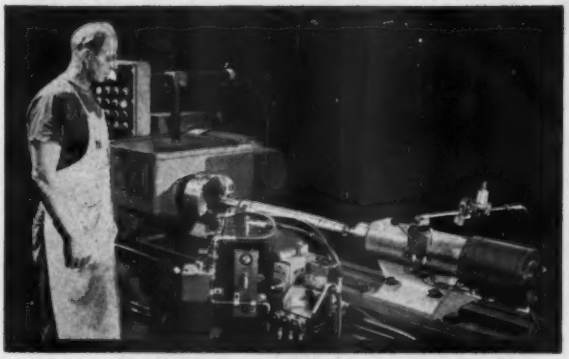
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



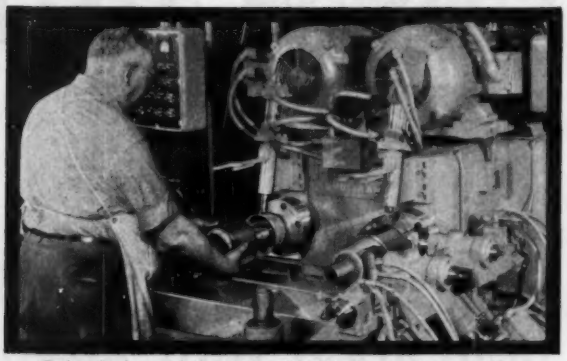




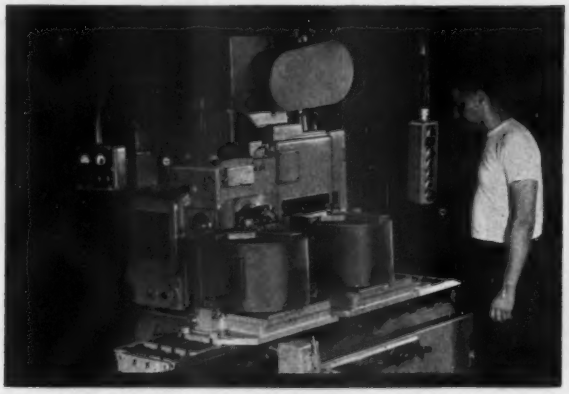
ELECTRIC MOTOR PARTS



Turning both ends of various sizes of motor shafts using a Sundstrand Multi-Cycle Tracer Lathe.

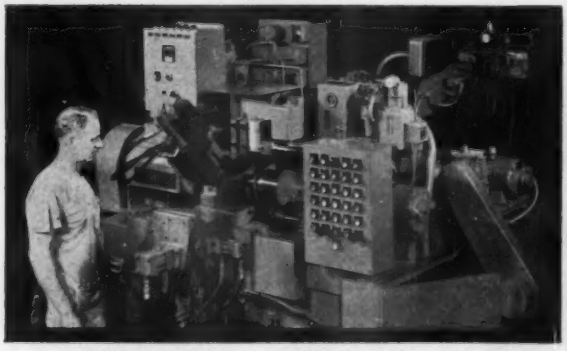


Facing, boring, and chamfering of both ends of stator assemblies on 2-spindle lathe. Operator loads and unloads one spindle while machining at second spindle.

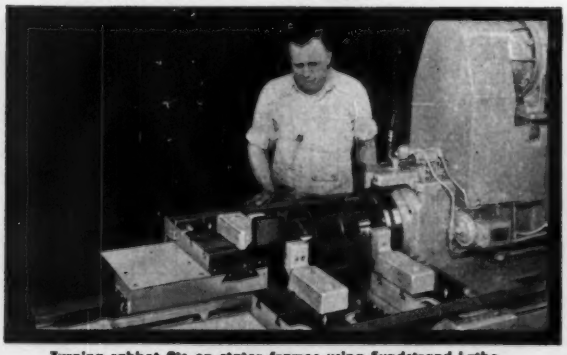


Milling feet on various sizes of stator frames on Sundstrand Rigidmil.

Special mill for boring stator frame assembly. Parts are loaded and unloaded at one station during machining at opposite station.



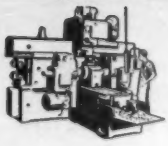
Special Sundstrand Lathe for turning, chamfering, and reaming rotor assembly. Machine has automatic tool re-setting, gaging, loading and unloading.

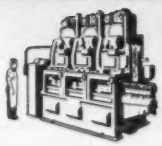


Turning rabbet fits on stator frames using Sundstrand Lathe. Machine handles standard motor frames from 204 thru 284 NEMA sizes.

ADDITIONAL DATA on Sundstrand's "Engineered Production" for jobs like these is available. Send part prints for a specific analysis today.

TRIPLEX RIGIDMILS | SPECIAL MACHINES

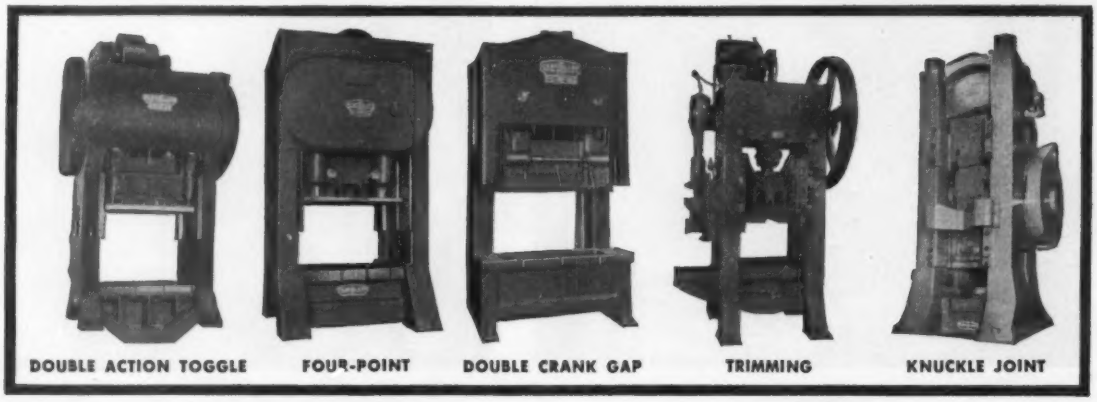




SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.

Cleveland Presses

help keep your plant competitive



If you do volume stamping, production-wise and cost-wise there's no better way to protect your competitive position than by prompt replacement of outmoded presses.

High stamping and maintenance costs are the penalty of inefficient press operation. Don't let them rob you of the cost of new, efficient presses.

Now's a good time to check your older press performance records. You may find that you're already paying for new presses . . . *without their benefits.* If so, you can make no better investment than the purchase of *new* Cleveland Presses equipped with the Cleveland (patented) Drum Type Clutch. Our engineers will gladly help you select the *right* Cleveland for your needs. Write or call today!

The CLEVELAND Punch & Shear Works Co.
Power Presses • Fabricating Tools • Punching Tools and Dies
East 40th and St. Clair Avenue, Cleveland 14, Ohio
Offices at: New York • Chicago • Detroit • Philadelphia • East Lansing • Cincinnati

THE CLEVELAND PUNCH & SHEAR WORKS CO.
Established 1880

Acme-FETTE

NEW SERIES - "N" SELF-OPENING THREAD ROLLING HEAD

lets you use your present equipment *(either rotating or stationary spindles)* for rolling threads from the end

VERSATILE—Same head can be used on any type of turning equipment—either rotating or stationary spindles—on all jobs which permit clearance for front plate. Reduces secondary operations.

FAST—Thread rolling speeds are equal to turning speeds with high-speed tool steels—on all ferrous and most non-ferrous materials; up to 5 times faster than conventional thread cutting methods.

SMOOTH, TOUGH, EXTREMELY ACCURATE—Metal flows to full depth of thread; forms a dense, uniform structure with no cratering at the crest; provides a burnished thread surface remarkably resistant to wear and corrosion.

NO CHIP PROBLEM—Thread Rolling with an Acme-Fette is ideally suited to multiple-spindle tooling setups.

FOR EITHER LONG OR SHORT RUNS—Production records (names on request) prove substantial cost savings due to easier setup, less down time and more mileage per set of rolls.

WIDE RANGE—8 Acme-Fette Thread Rolling Heads provide for capacities ranging from 1/16" to 2".

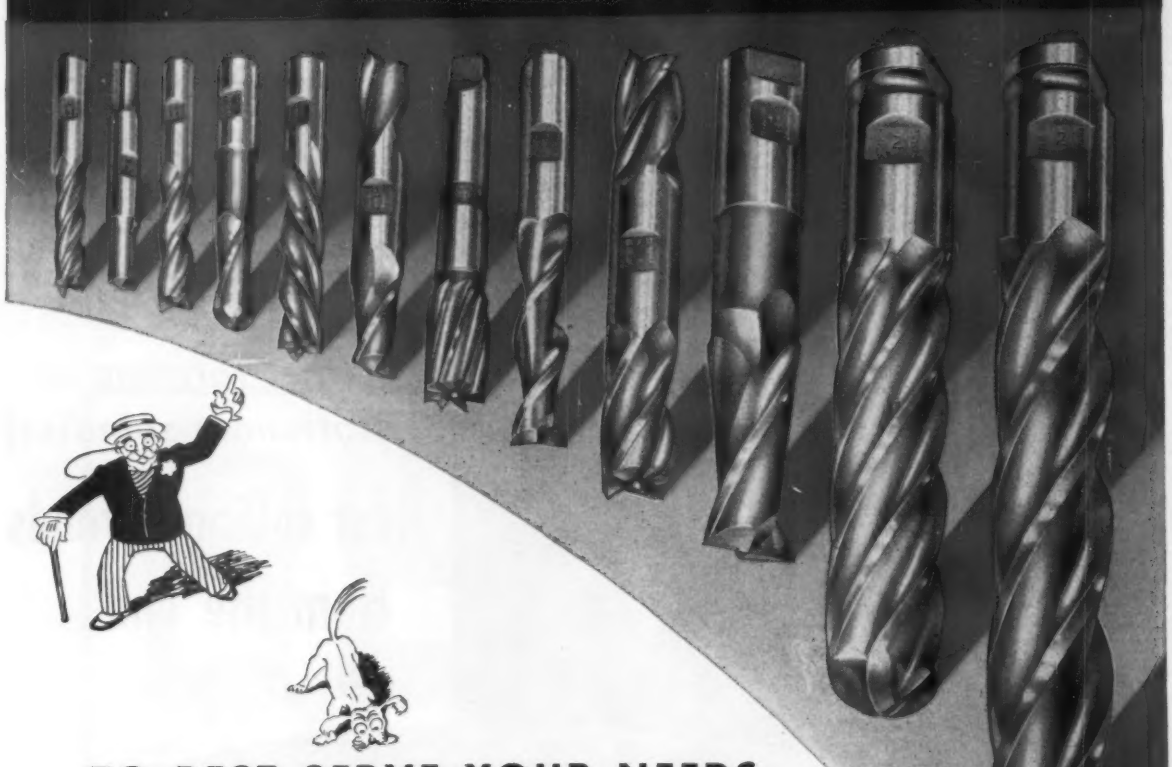
Check where Acme-Fette can help you keep more of your present equipment busy. Send sample or print for our recommendation — or write for your copy of Bulletin NAF-57

ACME-FETTE NEW SERIES "N" HEAD (Size 00) Rolling No. 6-32 Class 3 Thread on a Single Spindle Automatic Screw Machine.

National Acme

THE NATIONAL ACME COMPANY
171 EAST 131ST ST., CLEVELAND 8, OHIO
SALES OFFICES: Newark, Chicago, Detroit

END MILLS ARE OUR BUSINESS . . .
NOT A SIDELINE



TO BEST SERVE YOUR NEEDS

For over twenty years our designing and manufacturing abilities have been devoted to producing highest quality end mills. Because end mills are our business, we realize that universal acceptance of our product is obtained and maintained by continuously supplying the best end mills available.

Putnam manufactures and stocks over 1400 standard types and sizes of end mills. Thus, you can quickly and economically select the exact size and type to best meet your needs.

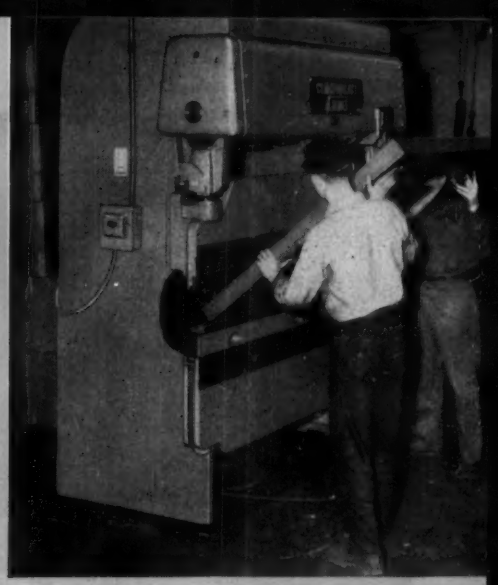
Putnam Distributors from Coast-to-Coast carry large stocks of standard end mills. Contact your neighbor, the local Putnam Distributor, he will recommend the best end mill for specific jobs, give you personalized service, and quickly supply your needs with the finest end mills obtainable.

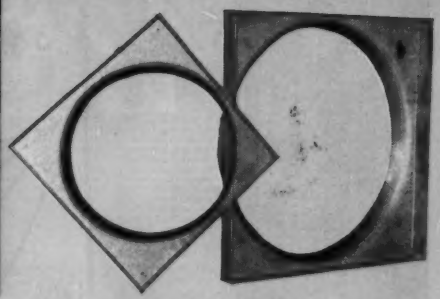
5853

PUTNAM TOOL COMPANY

2981 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN

Photos courtesy of Anchor Metal Spinning Company.





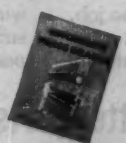
Typical fan housings produced by Anchor Metal Spinning Company.

Money and Time are saved

by this accurate CINCINNATI PRESS BRAKE

... at ANCHOR METAL SPINNING CO., Dayton, Ohio

Profitable production has been achieved by installing this Cincinnati Press Brake. Accurate flanging of fan housings is done rapidly while meeting the rigid requirements for squareness. Operations on different sizes and gauges of materials are performed with ease. Parts for assembly are ready on time and smooth economical shop operations maintained.



Write Department A for Bulletin B-6 "30 Ton and 50 Ton Cincinnati Press Brakes".

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

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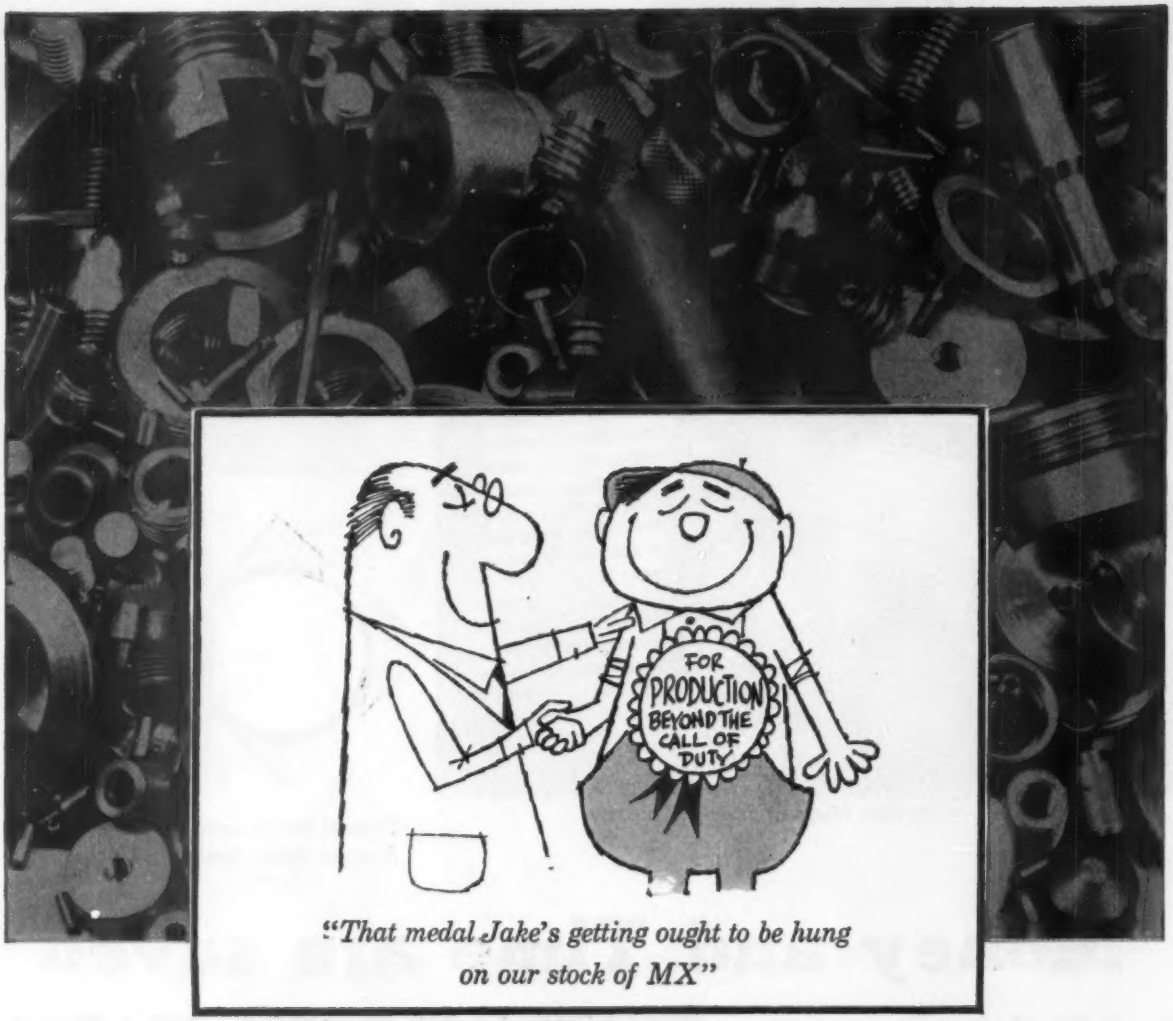


"That medal Jake's getting ought to be hung on our stock of MX"

To hang up production records takes more than modern equipment and experienced operators. You've got to use screw stock that makes it possible for both to perform at top efficiency.

That's why so many shops have switched to USS Free-Machining MX Steel. With this faster-cutting screw stock, production increases of 50% or more are not unusual . . . tool life is extended, frequently doubled, and down-time is correspondingly reduced.

What's more, with MX on the job, screw machine parts are not only turned out in record time but, because MX is consistently uniform in cutting characteristics and in freedom from injurious imperfections, parts made with MX are *better* parts—better in finish, accurate in dimension and with fewer rejects to cut into profits.

USS Free-Machining MX Steel has been successfully machined at speeds up to 350 SFM—yet it costs no more than regular screw stock.

Based on results obtained in producing more than a billion parts of many different kinds and under widely different conditions, we feel sure that *MX will cut the cost of any part* you now machine from regular screw stock grades. Why not prove it for yourself?

Available both in Bessemer and Open Hearth grades, USS Free-Machining MX is produced in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest district office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

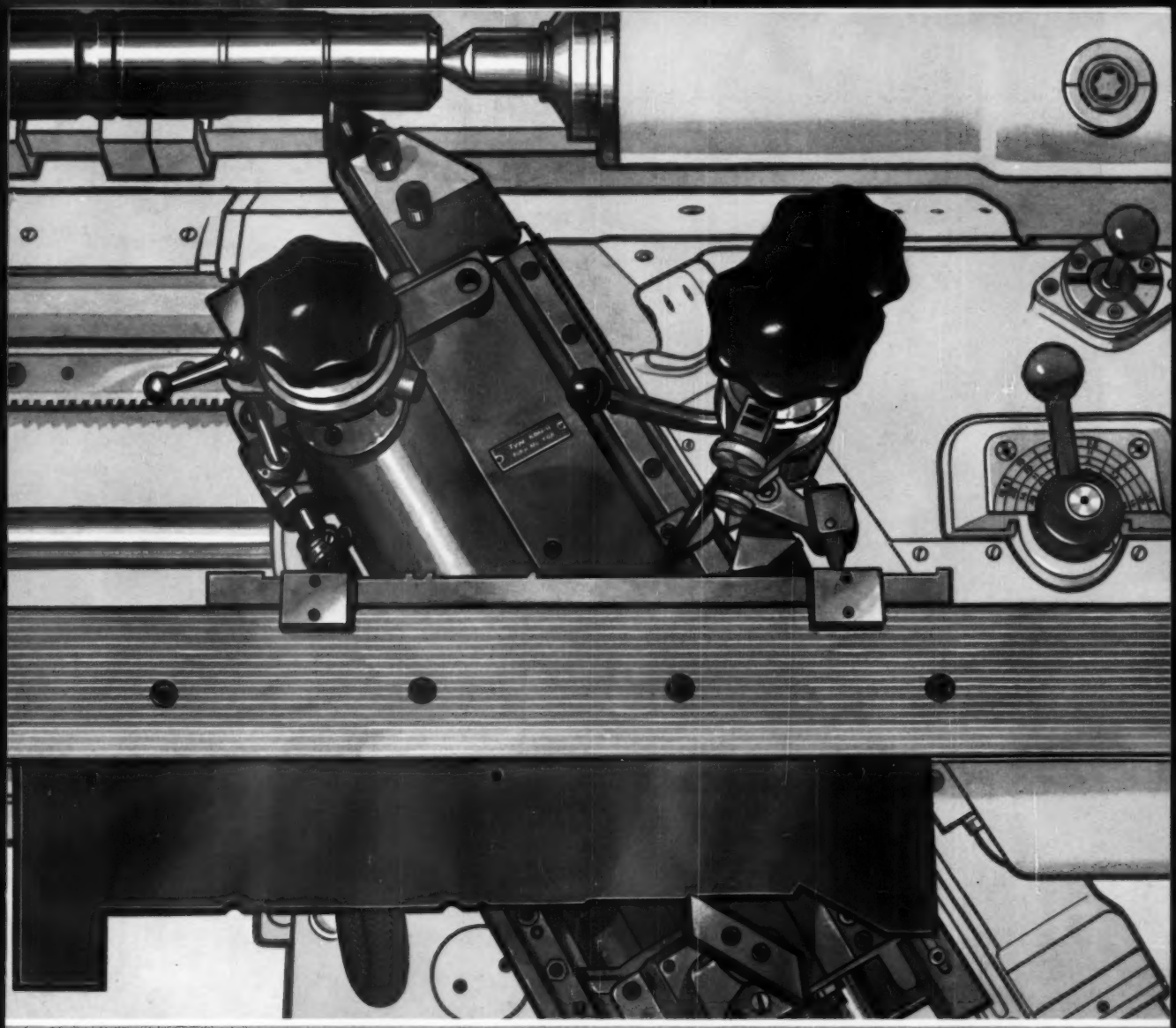
More parts . . . better parts . . . at lower cost per part

—when you do the job with free-machining

MX

USS

UNITED STATES STEEL



New Britain +GF+ outproduces multi-tool lathes with a single tool

How can one tool outproduce several? The answer is — maintain dimensional relationships with a template or prototype instead of a multi-tool setup. This cuts tool changeover time to practically zero.

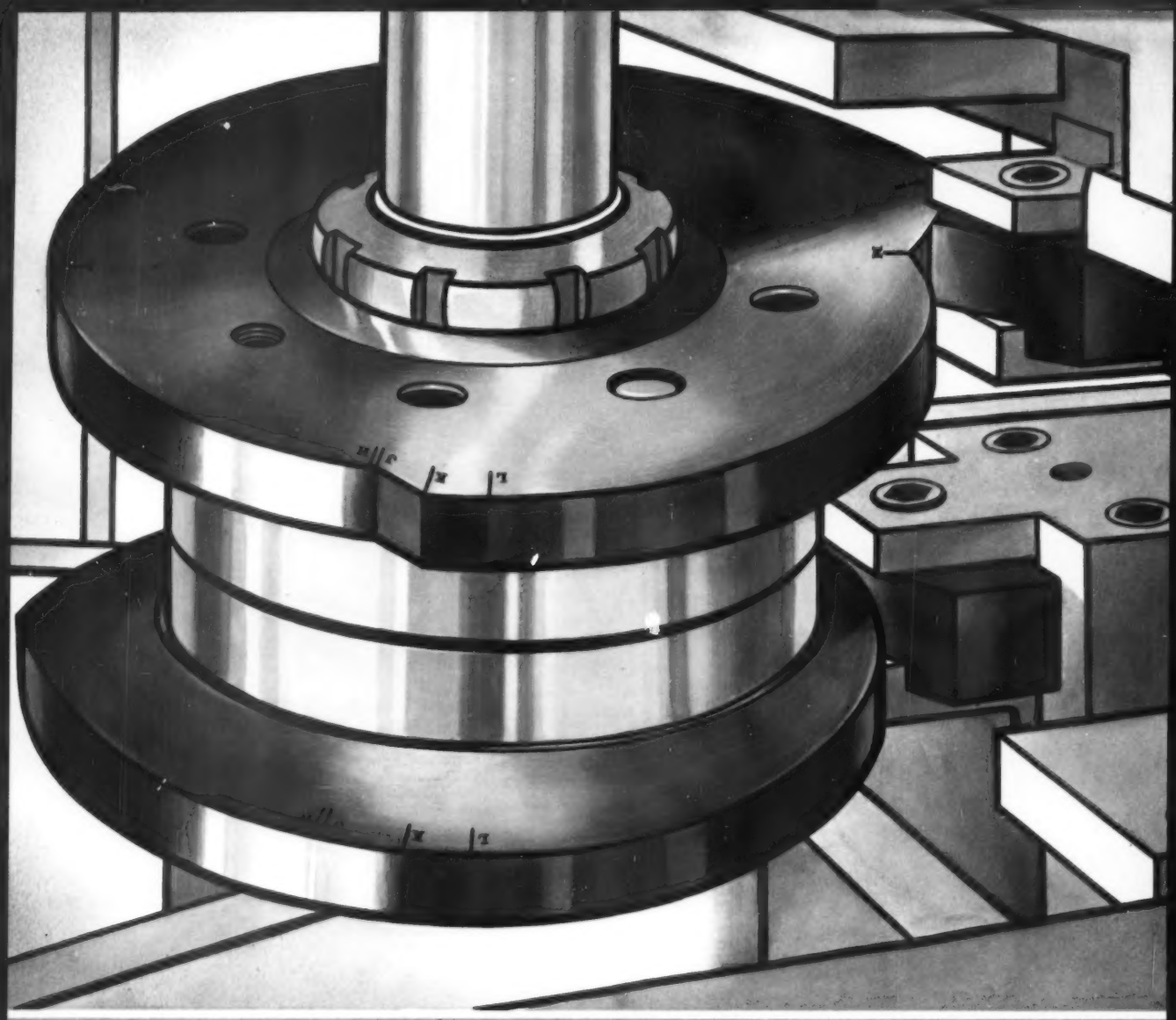
On the New Britain **+GF+** copying lathe, you can cut at maximum speeds and feeds for tool efficiency without worrying about tool wear and the delicate readjustment of several cutting tools. When the tool wears, change it, bring one dimension to size. The other dimensions have to be right. Your choice of a New Britain **+GF+** means elimination of any extra operation to bring pieces within grinding tolerances.

Machines from New Britain's three machine tool divisions incorporate the *basic principles* of more profitable production.

THE NEW BRITAIN MACHINE CO.

New Britain +GF+
Copying Lathe

NB



cams put the precision in precision boring

When you are working to "tenths" cams are your best method of maintaining accuracy, because cam control of the tool is *positive* control. The accuracy of parts produced on New Britain boring machines *can't* be affected by variable hydraulic pressures, ambient temperature, or play in complicated linkages.

In boring machines or *any* machine tool investment, be sure your most important requirements are met, not by gadgets, but by the fundamental design principles employed. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.
Precision Boring Machine
NB

CARBORUNDUM® INTRODUCES:

Maximum Automation Potential

newest concept in Abrasive Technology

predicts metal removal savings with abrasive belts before capital investment

M-A-P is a *new* industrial forecast method. It is designed for automation-minded manufacturers whose production operations include heavy stock removal, finishing or semi-finishing of component parts. M-A-P predicts operating-cost savings and production increases resulting from the engineered application of the correct machine and abrasive belts—in advance of any investment in material or equipment.

M-A-P is actually the application of science to metal removal—economic science and abrasive science combined to take the guesswork out of grinding. M-A-P formulas were developed by The Carborundum Company's Coated Abrasive Engineers from a study of all standards and factors entering into abrasive belt grinding operations. M-A-P is based on the accumulated knowledge of Carborundum's years of coated abrasive manufacturing experience and the abrasive machinery know-how of its Curtis Machine Division.

Maximum Automation Potential predictions are now available to you as a standard engineering service of The Carborundum Company's Coated Abrasives Division. To get an M-A-P study on one of your present or planned metal removal operations, you need only supply a few basic production facts. Carborundum engineers do the rest—M-A-P formulas are applied specifically to your operation—*an M-A-P Recommendation is then mailed back to you.* Now, with M-A-P you can *predict and compare* return on investment—without obligation.

For further information, write to The Carborundum Company, Dept. 37, M-A-P, Senior Coated Abrasives Engineer. Ask for the M-A-P Brochure which explains this new engineering service to industry in detail.

The **CARBORUNDUM** Company
COATED ABRASIVES DIVISION
Niagara Falls, New York

dixi 60

horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

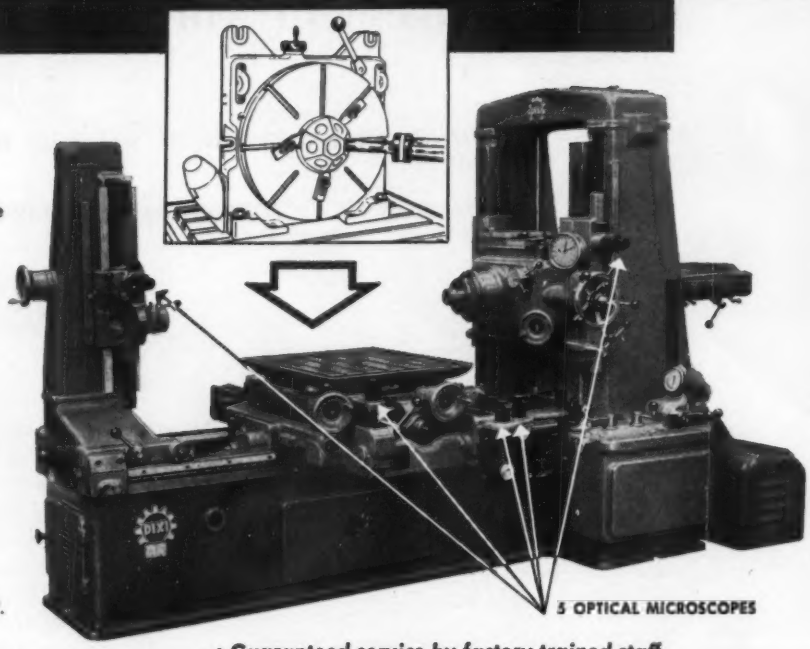
ACCURACY
Overall accuracy of .0002"

A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.



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- ***Guaranteed service by factory trained staff***
- ***Engineering staff available for consultation***
- ***Spare Parts in New York stock***
- ***Your operators trained***

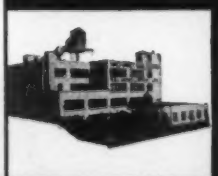
DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.

Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.

MBI



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Call the "STANDARD" Man . . .
to advise the most economical operating procedure, based on knowledge and long experience.

He will help you select the best type of tap for your job from their *Complete Family* of metal cutting tools.

Quality Tools Since 1881

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FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Carbide Tools · Gages*

They add up!...

the savings made by converting these five screw machine parts from brass to Kaiser Aluminum add up to $7,720.00 a year for Minneapolis-Honeywell Regulator Company... All five parts run at maximum efficient speed on present machines with little or no change in tooling or equipment... Result?—Minneapolis-Honeywell is now studying further conversions... If you bid for screw machine parts business, why not offer your customer savings like these with an alternate bid in...

Kaiser Aluminum

For complete information and expert assistance, call one of our many distributors, or look for our local number in your classified telephone directory.

Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois; *Executive Office*, Kaiser Bldg., Oakland 12, Calif.

See "THE KAISER ALUMINUM HOUR," Alternate Tuesdays, NBC Network. Consult your local TV listing.

Adjusting Knob
for Room Thermostat

Cost per 1,000 parts:

Brass	$16.10
Aluminum	9.44
Savings	$ 6.66
Percent Savings	41.3%

Cover Screw
for "Protecto Relay" Unit

Cost per 1,000 parts:

Brass	$16.80
Aluminum	10.80
Savings	$ 6.00
Percent Savings	35.7%

Tension Nut
for "Immersion Aquastat"

Cost per 1,000 parts:

Brass	$9.10
Aluminum	4.50
Savings	$4.60
Percent Savings	50.5%

Adjusting Screw
for "Immersion Aquastat"

Cost per 1,000 parts:

Brass	$11.90
Aluminum	7.33
Savings	$ 4.57
Percent Savings	38.5%

Packing Nut
for Temperature Controller Unit

Cost per 1,000 parts:

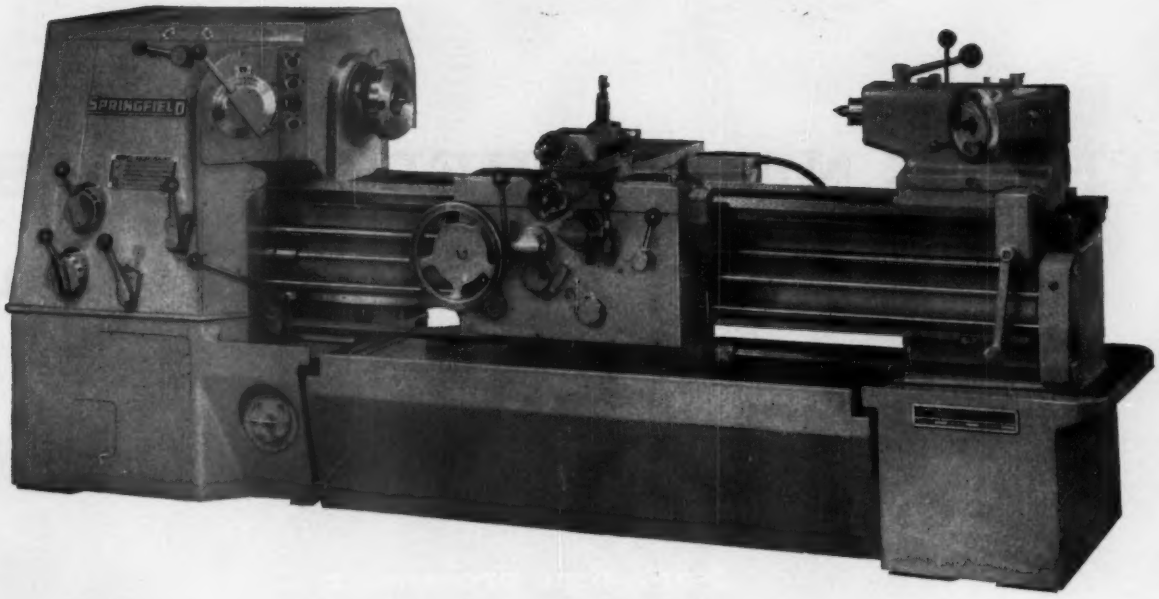
Brass	$33.60
Aluminum	21.45
Savings	$12.15
Percent Savings	36.2%

Recommended by Managements

Specified by Designers

Preferred by Operators

SPRINGFIELD



more useful horsepower

All the horsepower in a Springfield Model "S" Lathe is productive.
A simple, straight-forward gear train, plus double-action lubrication, plus tight dynamic balance tolerances (.0005" displacement) eliminate friction and vibration, the twin horsepower thieves.
In the headstock, only the gears necessary to a given speed are engaged. Other gears run free with a stabilizing flywheel action, no drag on power.
A high pressure filtered oil mist keeps all gears and bearings drenched, and a cascade of oil lubricates the feed box.

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".
Vertical Universal Grinders: swings 18" to 42".

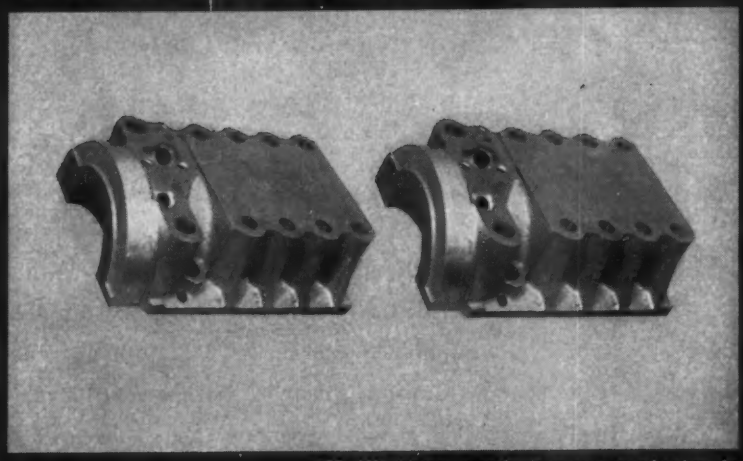
The Springfield Machine Tool Company
Springfield, Ohio

68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

SPRINGFIELD

THREE NEW DEVELOPMENTS
Increase Production

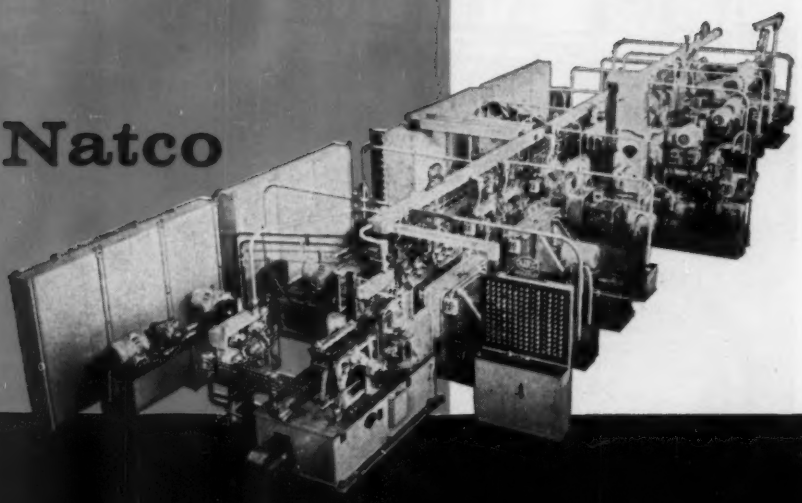
2-at-a-time processing



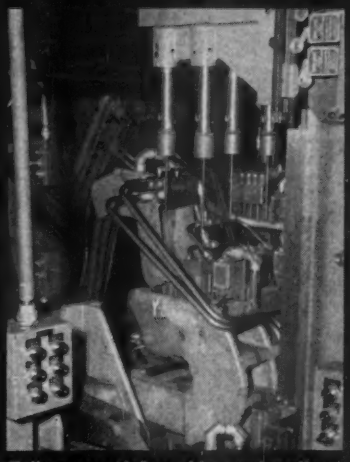
300 HP Natco greatly increases production by processing two complete sets of bearing caps at once.

Bearing caps—240 *sets* per hour—six times the production rate of the machine replaced! This new Natco processes two complete sets at once. It loads surface-broached castings automatically, performs 80 machining operations, places matched sets of finished bearing caps on the assembly conveyor. In addition to broaching and sawing, this 300 HP, 27-station Natco, drills, reams taps, turns, mills, probes and faces.

help this Natco 600%

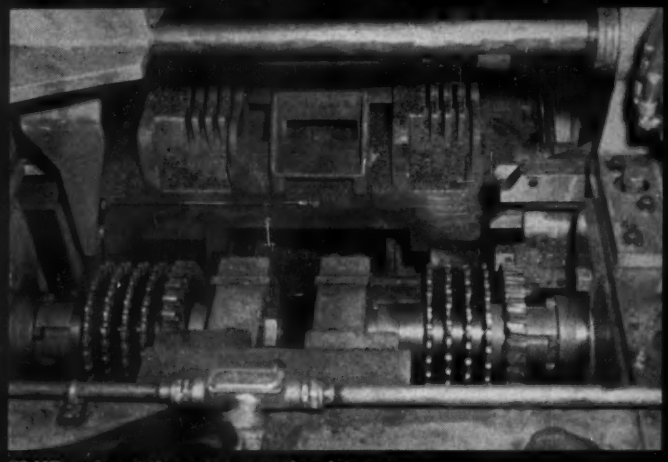


Unique Broaching Station



Fully automatic broaching station eliminates need for withdrawing broaching tools after cut. Broaching tools are pulled completely through hole, removing .030" stock.

New Rigid Saw Station



80 HP sawing station cuts two castings into complete sets of 5 caps each. All surfaces parallel within .0015". Fixture feeds castings into stationary mounted saws, providing rigidity for accurate 14 ipm cutting.

Whatever your high production problem, our engineers will work closely with your people to develop exactly the method and the machine to do your job best. Besides special way-type, index and transfer machines, Natco also builds multiple drilling, boring, facing and tapping machines. Call your nearest Natco office in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles. Distributors in other cities.

Partners in Production

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC. *Richmond, Ind.*

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan

Automatic

FULL-UNIVERSAL MACHINES
for
DRILLING—TAPPING—THREADING

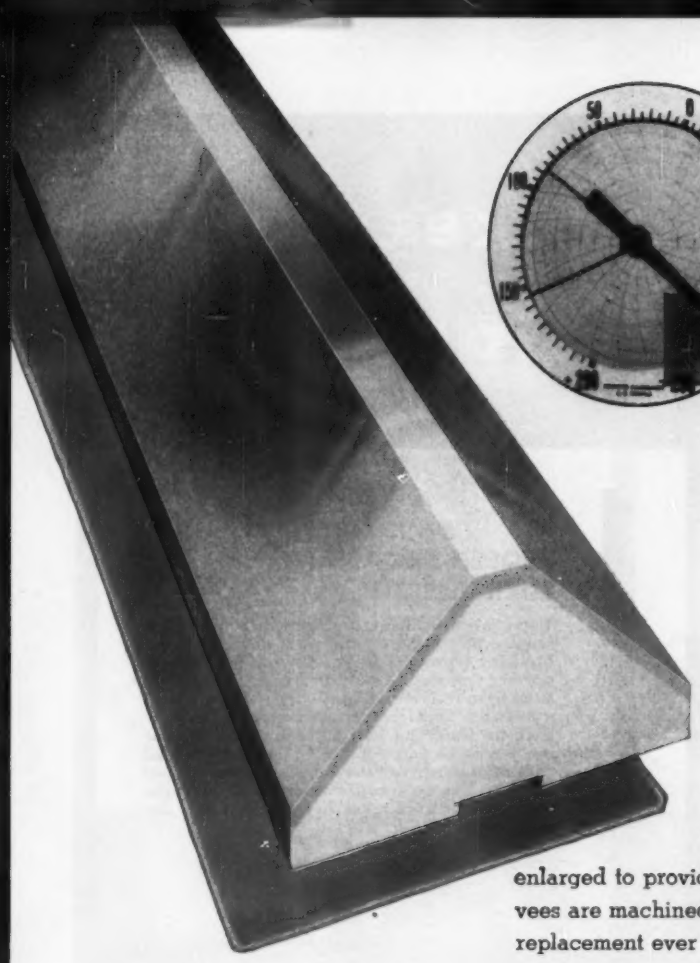
Batteries of Snow machines are found in many plants where high production output must be combined with quick set-up, low tooling cost, and the highest degree of accuracy.

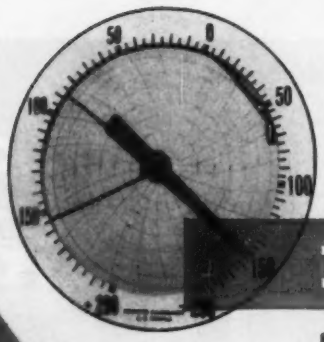
A section of the second operation department of the REVERE CAMERA COMPANY is shown where the precision components for REVERE cameras and projectors are processed.

Where "quality" of product is of extreme importance, the decision is to standardize on Snow equipment.

Single Spindle Machines
Two Spindle Machines
Angular Machines
Drilling and Tapping Units
Automatic Jigs and Fixtures
Nut Tapping Machines
Horizontal Machines
Drill Press Tap Heads

SNOW
MANUFACTURING COMPANY
435 EASTERN AVENUE, BELLWOOD, ILL.
(Suburb of Chicago)





150° BELOW

After hardening to 62 Rockwell C the solid tool steel "AMERICAN" Pacemaker bed vees are stabilized in the deep freeze at 150 degrees below zero.

This freezing treatment not only raises the surface hardness but thoroughly stabilizes the metallurgical structure and prevents twisting or warping.

On the new DeLuxe Model "AMERICAN" Pacemaker the bed vees have been enlarged to provide extra large bearing area for the carriage. The vees are machined to gauge tolerances for interchangeability should replacement ever be required.

This is but one of the outstanding advantages offered by the new DeLuxe Model Pacemaker. Others are illustrated and described by bulletin No. 124—want one?

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

"Engineered Production" Service

FOR BROACHING

It takes all 3

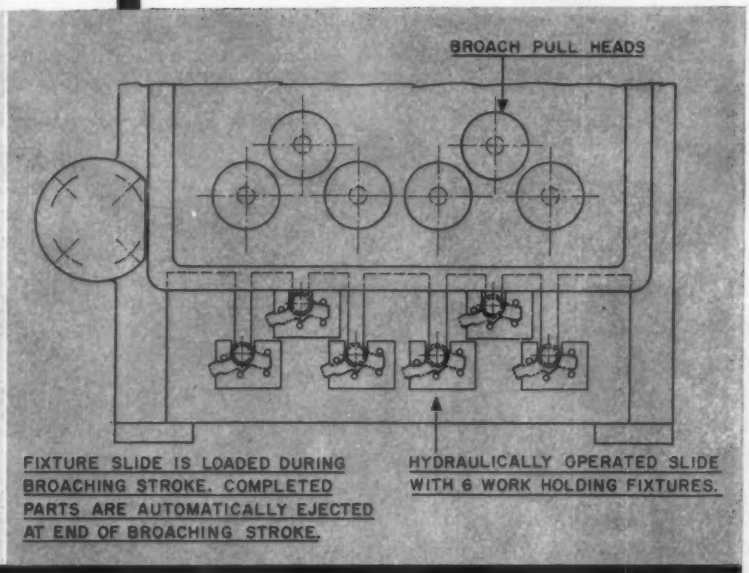
American's *"Engineered Production"* Service . . . gives the broach-user the complete three-part service that is vital for handling a production broaching job. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

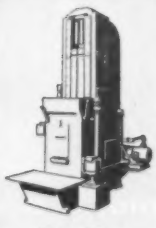
THE JOB Broaching I. D. of hole in exhaust valve rocker. High production required.

THE RESULT 1200 parts per hour, broached *six at a time*, on vertical internal pull-up machine equipped with sliding fixture.

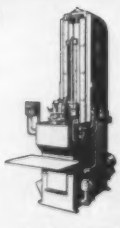
1 PROPER BROACH TOOL DESIGN

Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers, stock removal, length and width of cut, finish, tolerances required, etc. American's experience in designing and building broaches for every type of part capable of being broached pays off in quality of the work and in long tool life. You can be sure the broach and machine will operate as a team because they are designed that way.

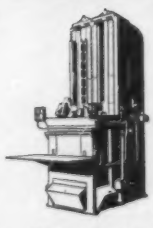

BROACH PULL HEADS
FIXTURE SLIDE IS LOADED DURING BROACHING STROKE. COMPLETED PARTS ARE AUTOMATICALLY EJECTED AT END OF BROACHING STROKE.
HYDRAULICALLY OPERATED SLIDE WITH 6 WORK HOLDING FIXTURES.



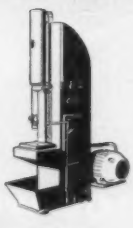
Three Way



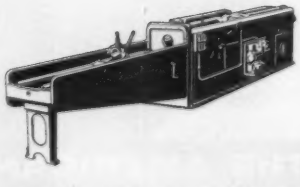
Single Ram



Duplex Ram



Presses

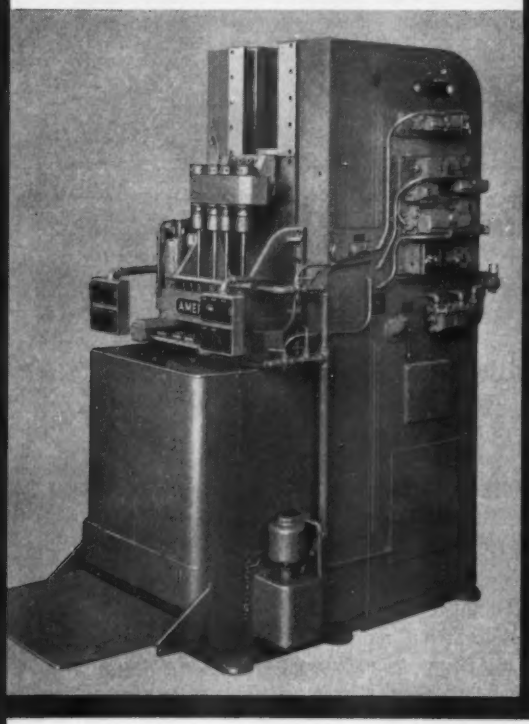


Horizontal

to give you peak broaching performance

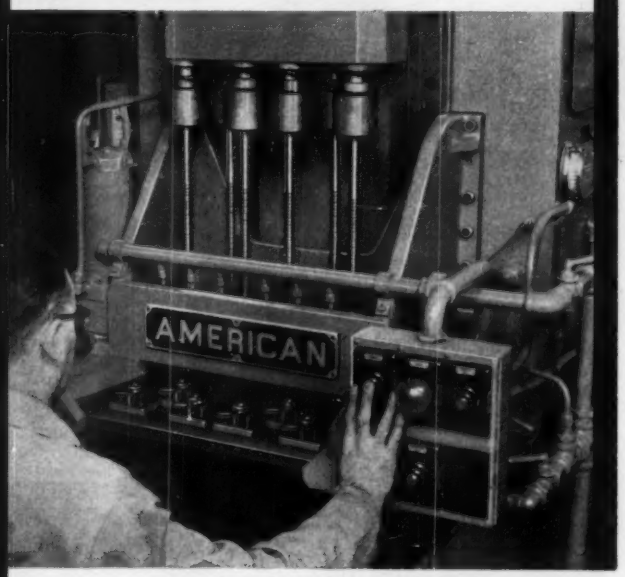
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, and available floor space dictate the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. Because American builds a complete line of standard machines and has extensive experience with specials, you can depend on getting the most practical machine for your job.



3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Whether manual loading and unloading is used or the work cycle is completely automatic, workholding fixtures designed and built by American Broach feature easy loading and unloading coupled with positive clamping during the broaching cycle. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.



WRITE for Bulletin A112 for more information on practical broaching methods by American.

SUNDSTRAND AMERICAN *American* BROACH & MACHINE CO.

A division of SUNDSTRAND MACHINE TOOL CO.

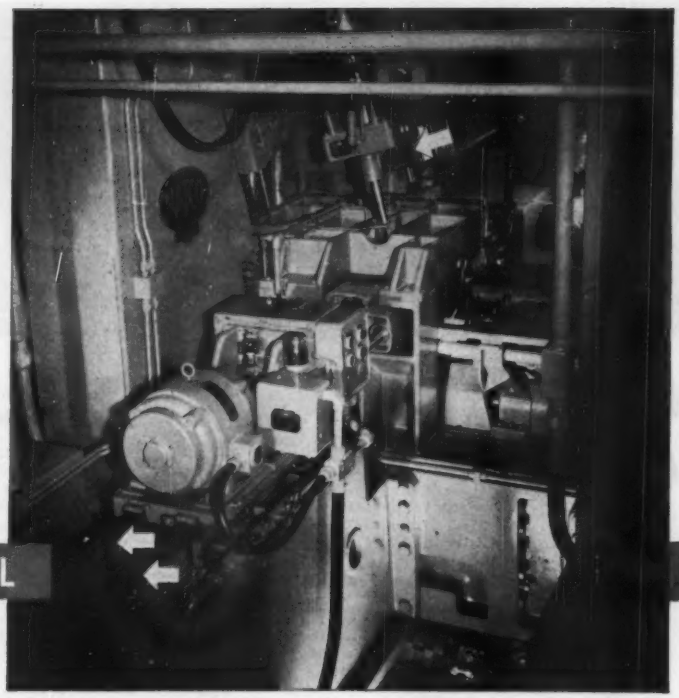
ANN ARBOR, MICHIGAN

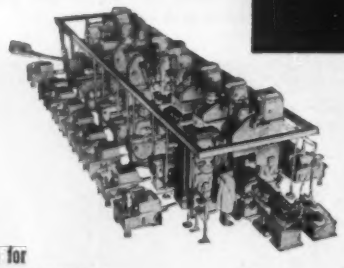
See *American* First —for the Best in Broaching Tools, Broaching Machines, Special Machinery

50 Auto Blocks An Hour!

WITH THE HELP OF Allegheny Ludlum

SARATOGA TOOL STEEL





Allegheny Ludlum Saratoga was used for the steel ways (note arrows, above) of this giant unit, illustrated at left in a bird's-eye view reduced to miniature size.

Write for BLUE SHEET ON SARATOGA

This concise four-page folder gives all needed handling and shop treatment details on Saratoga. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. AM-87

98 SEPARATE OPERATIONS are carried on by this versatile machine which turns out 50 V8 auto engine blocks an hour. It consists of 18 machining units, each of which is fitted with hardened and ground steel ways of A-L Saratoga to guarantee accuracy in production.

MILLING, TREPANNING, DRILLING, counterboring, reaming, chamfering, automatic inspection of holes for depth and removal of chips are the operations performed by this amazing mechanism.

SARATOGA WAS USED BECAUSE its extreme hardness, high resistance to wear, and excellent machinability more than met the customer's high requirements for maintaining accuracy in this huge, multi-station machine.

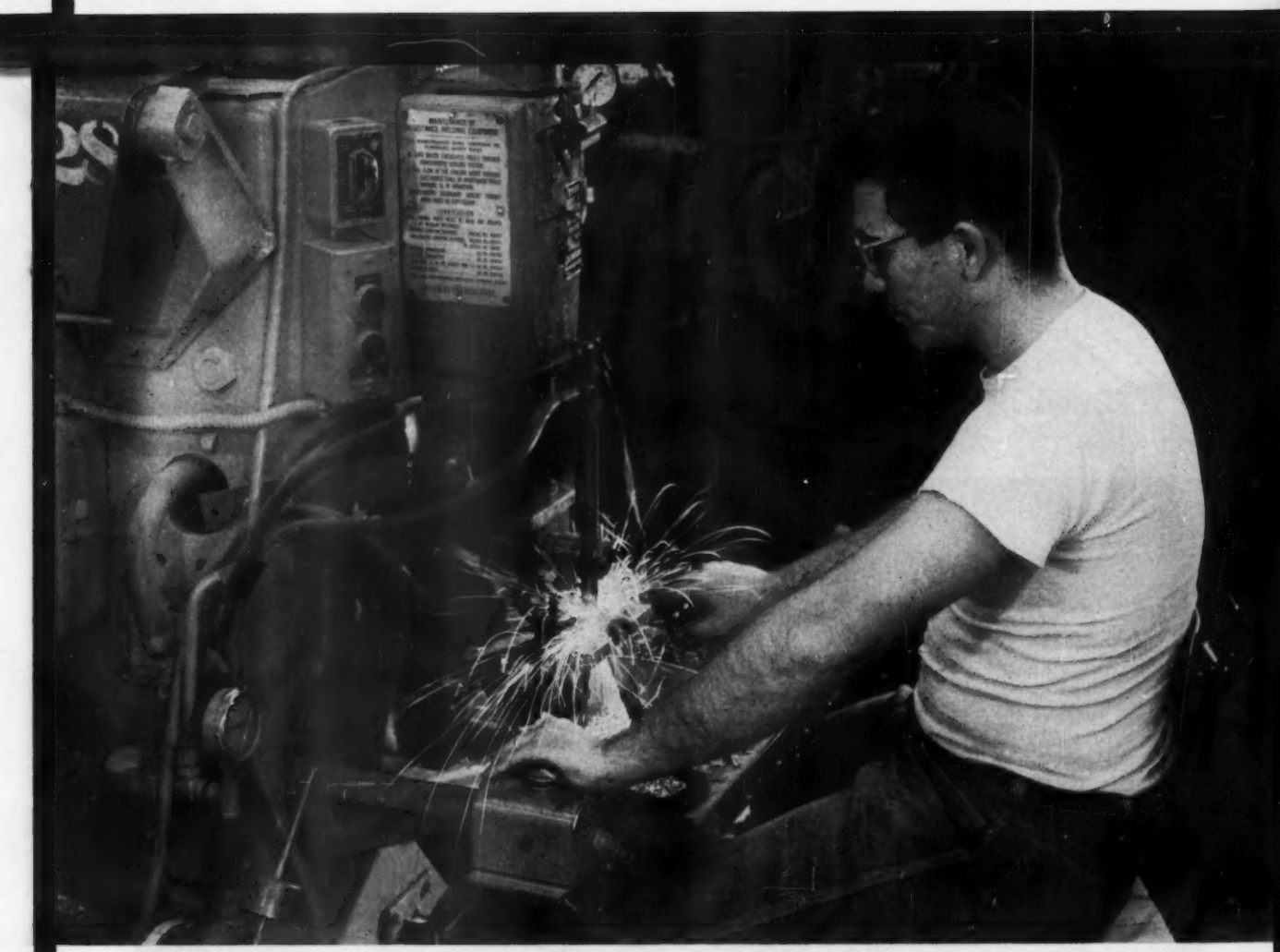
ALLEGHENY LUDLUM METALLURGICAL SERVICE can solve *your* tool or die steel problems. ● Call your local A-L representative or distributor, or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call Allegheny Ludlum

WBW 6305

AL® FINE TOOL STEELS SINCE 1854



Resistance welding machine is operated by a two-button start-stop station and two heavy-duty stations with mushroom-head buttons.

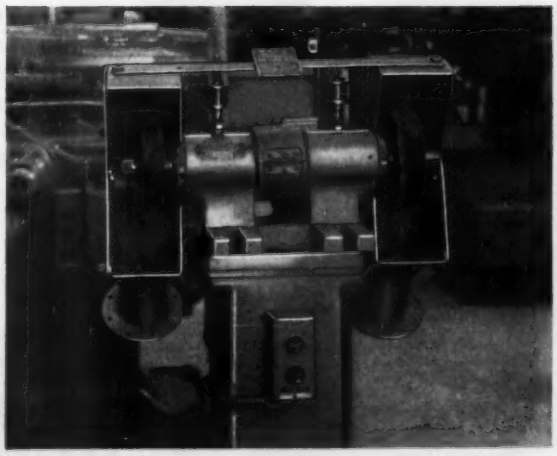
Two ways General Electric pushbuttons save you valuable production time

FAST DELIVERY. You can save valuable production time by using General Electric standard- or heavy-duty pushbuttons because G-E distributors keep a complete stock of these stations. You can get the forms you want, when you want, simply by calling your General Electric distributor.

DEPENDABLE OPERATION. Once installed, General Electric pushbuttons save you more production time because they are built for dependable service. Durable enclosures are made of steel for strength and safety. Large silver contacts are designed for long life. Good contact is provided by strong button springs which reduce chance of contact freezing.

Standard-duty pushbuttons are available in 1 to 3 unit stations, heavy-duty push buttons in 1 to 6 unit stations. Contact your nearest G-E distributor for more information, or write advertising Section 733–29, General Electric Co., Bloomington, Ill. Ask for bulletin GEA-6544, "Standard- and Heavy-duty Pushbuttons."

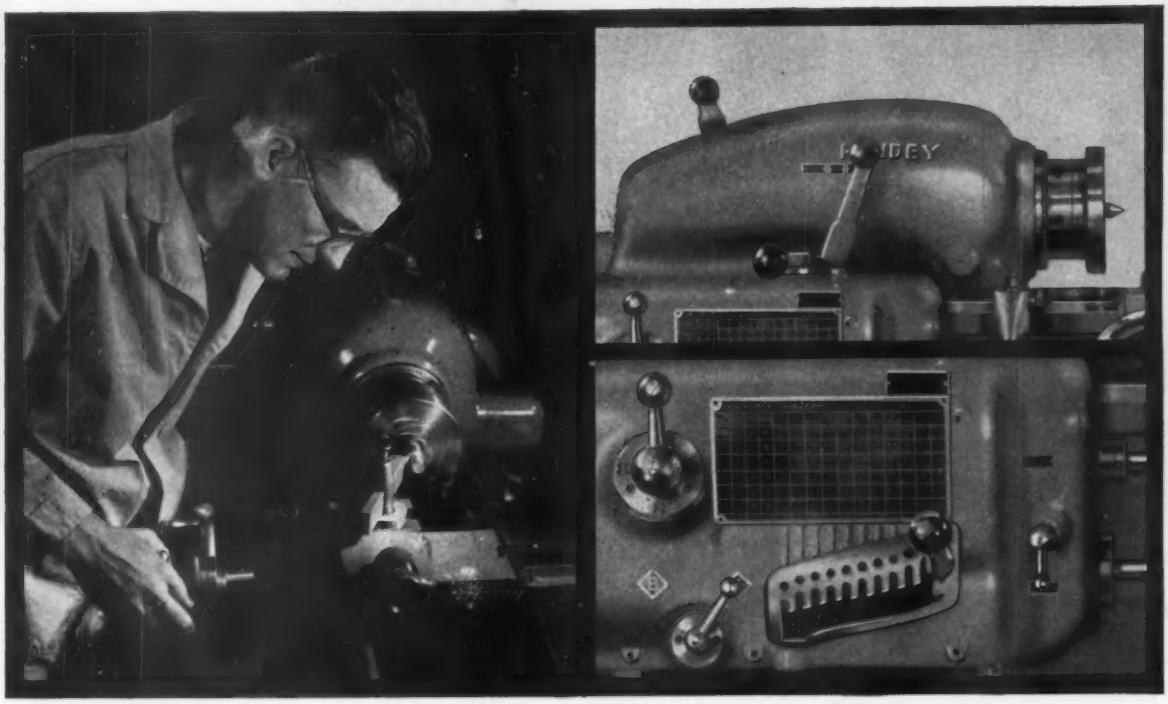
GENERAL ELECTRIC



General Electric standard-duty pushbutton station provides economical and dependable start-stop operation as on the grinder above.

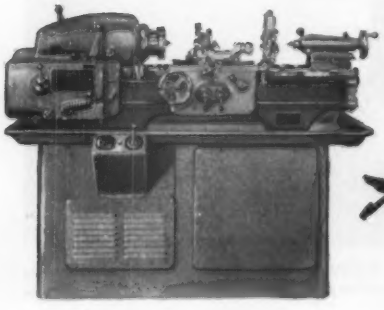
More features per dollar
than any other lathe
in its class!

Hendey 9" tool and gage-makers' lathe



High-speed, precision machining like the job above is backed up by Hendey features — like precision, antifriction bearings at both ends of spindle (upper right), and quick-change gearbox (lower right) for 66 changes of threads.

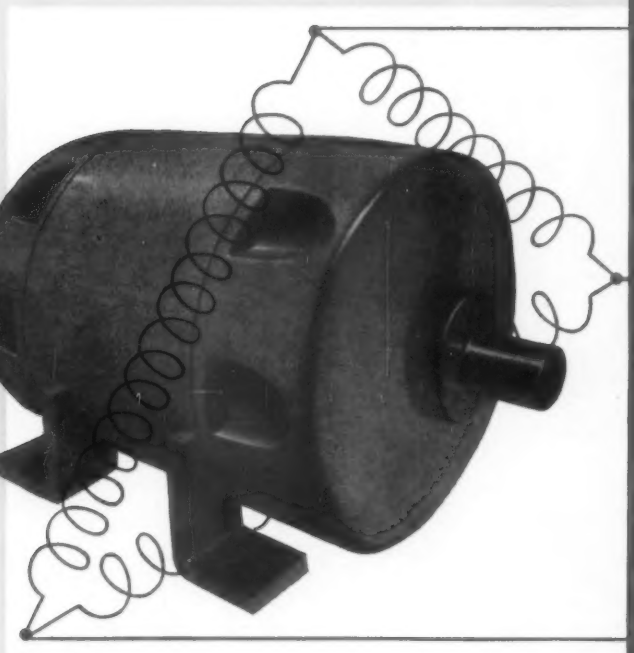
Infinitely adjustable spindle speeds from 15 to 3000 rpm — adequate speed for best results with carbide tools — both are yours with the magnetic amplifier drive on the Hendey 9 in. x 24 in. toolmakers' lathe. Geared feeds are from .002 in. to .120 in. per revolution of the spindle while belt-driven feeds range from .001 in. to .060 in. Every detail is designed for toolroom accuracy and long, trouble-free operation — yet the cost is below that of conventional machines. Ask your Hendey dealer about complete facts and features!



for precision with production, buy Hendey

Hendey **machine division**
BARBER-COLMAN COMPANY
31 Loomis St., Rockford, Illinois

BARBER COLMAN



SIMPLE DEPENDABLE protection against phase failure and phase reversal

A-B protector

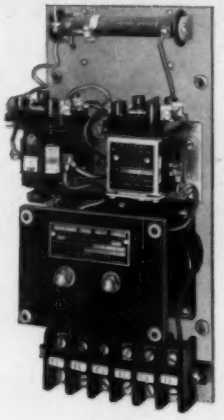
opens control circuit in 3 to 4 cycles...under all load conditions

When men, motors, or the driven machines can be "hurt" by "phase failure" or "phase reversal" . . . the new Allen-Bradley Bulletin 812 should be used as a low cost and reliable "safety" insurance. It detects phase failures and reversals electrically, and within not more than 3 or 4 cycles, opens the motor control circuit—regardless of motor load (including no load)—and thus stops the motor.

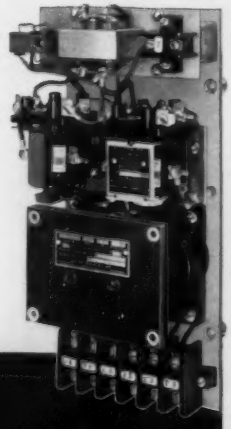
The Bulletin 812 Type A relay protects motors against all phase failures. The Type B relay protects motors against loss of a phase and reversed phase rotation. For the first time, dependable protection is provided for motors supplied by Wye-Delta and Delta-Wye power systems having the neutral ungrounded or not connected to the circuit.

Bulletin 812 relays offer positive protection against motor or machine damage due to opening a primary line—and under all "load" conditions. No field adjustment is required. Remote reset is inherent. Furthermore, as a static device which does not rely for its operation on "motor" revolution the possibility of failure to operate is eliminated.

Bulletin 812 relays are built in four sizes which will reliably protect motors with full load currents from 1.25 amperes to 300 amperes. Let us send you more information about this dependable answer to phase failure and phase reversal problems.



Bulletin 812 Type A phase failure relay protects a 3-phase motor against loss of a phase.



Bulletin 812 Type B phase failure and phase reversal relay protects a 3-phase motor against both loss of a phase and phase reversal.

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

A-B Quality

Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.

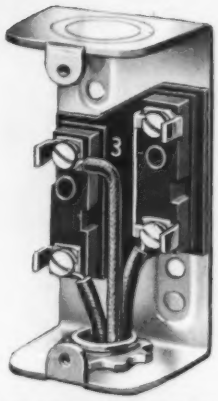
In Canada—
Allen-Bradley Canada Ltd.
Galt, Ontario

4-57-MR

new Allen-Bradley Bulletin 800 Standard-duty Push Buttons

CAN BE WIRED IN HALF THE TIME!

CONTACT MECHANISM IN THE COVER—COMPLETELY PROTECTED FROM CARELESS SCREWDRIVERS AND CARELESS WIRING.



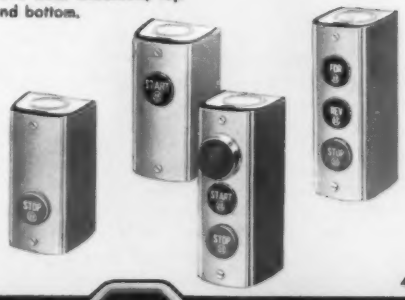
WIRING TERMINALS IN THE BASE —COMPLETELY EXPOSED FOR EASY WIRING.

Here's an entirely new idea in push button stations—a wrap-around cover which contains and protects the contact mechanism. Removing the cover exposes all terminals for instant and easy wiring. Heavy, silver plated contacts connect the push button assembly in the cover with the terminals in the base.

Matching ribs in the cover and notches in the molded terminal base eliminate the possibility of having wiring connections made incorrectly. A molded, bakelite shield protects the contact mechanism and prevents careless wiring from interfering with contact operation. All push button contacts are silver and of the double break construction.

Specify the new Allen-Bradley standard-duty station on your next order. Its installation time-saving feature, alone, should make you a regular customer!

Bulletin 800 standard-duty push buttons—with strong, gray, molded cover are "good-looking" and "safe" in operation. All stations have dual knockouts, top and bottom.



4-57-MR

SELECTOR SWITCH

You can't beat this for convenience—a selector switch with the same easy-to-wire construction as the push buttons, shown above—plus the feature that you can change—*in seconds*—from two position to three position (or vice versa)! The correct name plate is furnished with each switch. See for yourself how easily this is accomplished.

CHANGE IT FROM 2 POSITION TO 3 POSITION (or vice versa)... in 30 Seconds!

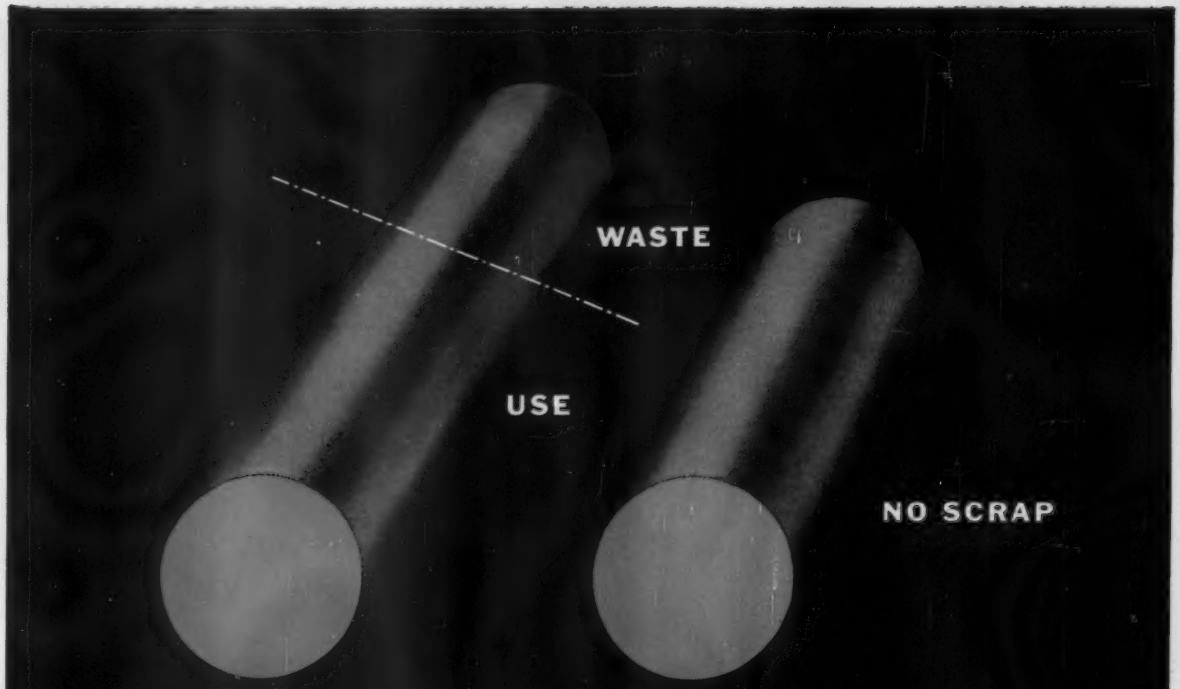
A-B Quality

ALLEN-BRADLEY

QUALITY

MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ontario



Want to save 7%...15%...up to 48%? Use Asarcon Bearing Bronze

When you buy standard 13-inch bronze bars, you have a "remnant" problem.

A one-inch remnant on a 13-inch bar, is a 7.6 per cent loss; a two-inch remnant is a 15.3 per cent loss; and, if you bought a 13-inch bar when you needed only 6¾-inches, your loss could run as high as 48 per cent.

When you buy Asarcon 773 Continous-Cast bearing bronze, however, you can get the *exact* lengths you need, all the way up to 105-inches. You save on short-end scrap; moreover, you'll find that you're saving on diameter losses and machining time as well. For, with Asarcon 773 you order the *diameters* you want, up to 9-inches. The clean-up allowance for the size you specify is in the piece you get, and is less than the common ¼ inch on rough-cut bars; and Continous-Cast cored bars save you costly machining time plus the weight of the core metal.

Asarcon 773 (SAE 660) is stocked—in 260 sizes, solids and tubes – by a national network of conveniently located distributors. Talk to one of them, or write directly to us. We'll be glad to show you how other companies are turning short-end scrap losses into savings.

ASARCO

Continuous-Cast Products Department

AMERICAN SMELTING AND REFINING COMPANY

Perth Amboy Plant, Barber, New Jersey • Whiting, Indiana

WEST COAST SALES AGENT: Kingwell Bros. Ltd., 457 Minna Street, San Francisco IN CANADA: Federated Metals Canada, Ltd., Toronto and Montreal

POSITION (or vice versa)... in 30 Seconds!

NIAGARA HAS THEM!

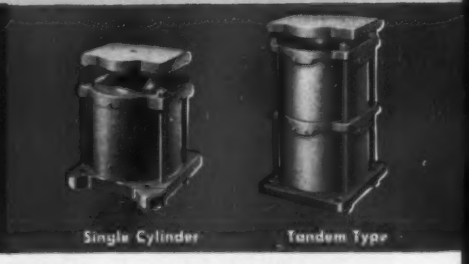
SERIES A, 5½ - 110 tons

SERIES AA, 32,200 tons

SERIES E, 75-200 tons
Front-to-Back Crankshaft

READILY EQUIPPED TO HANDLE

14 pt. Mechanical Sleeve — 18 pt. Electro-Pneumatic Sleeve — Electro-Pneumatic Friction



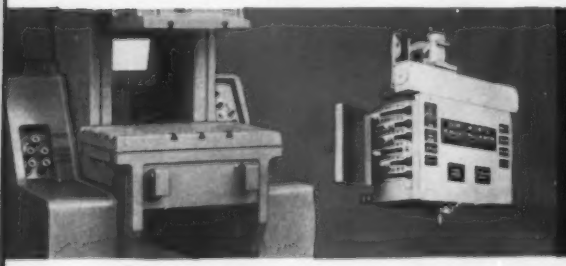
Single Cylinder — Tandem Type

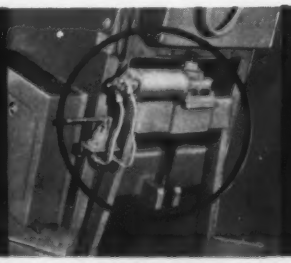
THREE TYPES OF CLUTCHES

Each Niagara Inclinable features the clutch best suited for the purpose. (1) Famed Niagara multi-jaw mechanical sleeve clutch. (2) Exclusive Niagara multi-jaw Electro-Pneumatic sleeve clutch. (3) Niagara low inertia Electro-Pneumatic friction clutch.

FOUR TYPES OF DIE CUSHIONS

Designed and manufactured by Niagara, single cylinder and tandem type pneumatic die cushions are built in 4 types to make any Niagara Inclinable a double action press. Self-lubricating models are available for automated OBI's.





SPECIAL BOLSTER PLATES
J.I.C. CONTROLS — FLANGED SLIDES
POWER SLIDE ADJUSTMENT
FLYWHEEL BRAKE
DIE AREA LIGHTING
MOTOR CUTOUT SWITCH

EQUIPPED FOR AUTOMATION

Featuring the most advanced controls and devices, Series EA (automated models) are engineered for peak productive capacity. Here's a line of OBI's that is completely equipped by Niagara for operation in your automation lines.

POWER INCLINING DEVICE

Fast-acting, safe and easy to operate, Niagara's air motor inclining device (shown above) is furnished as an optional accessory.

WIDE CHOICE OF ACCESSORIES

With a full selection of modern press accessories available, Niagara Standard Inclinables are adaptable to the widest possible range of job assignments.

standard OBI presses in all sizes and types that are right for you!

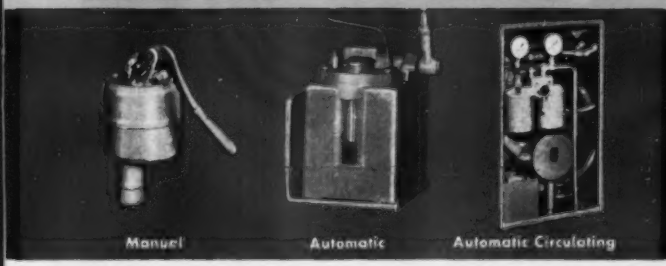
SERIES EA (Automated), 75-200 tons
Front-to-Back Crankshaft

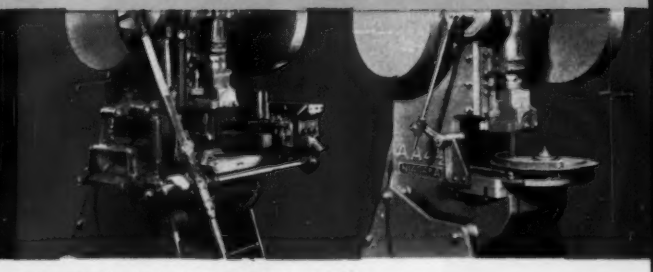
SERIES BI, 60-200 tons
Double Crank

5 LINES . . . 34 MODELS
EACH A CHAMPION IN ITS CLASS:

Niagara offers you industry's most complete, most modern, and *most* exclusive selection of standard inclinables . . . *plus* an unequaled choice of press accessories and automatic devices to meet your specific job requirements. You can count on Niagara for inclinables that will do the most to speed production, assure accuracy, prolong die life and hold down maintenance costs within your plant.

YOUR WORK MOST PROFITABLY





CENTRALIZED LUBRICATION TO FIT THE NEED

Niagara Inclinables are readily equipped with either manually-operated or automatic lubricators, or automatic circulating oil systems. It's one of the many ways in which Niagara outfits standard inclinables to meet individualized requirements.

ALL TYPES OF AUTOMATIC FEEDS

To speed production, Niagara Inclinables are easily equipped with complete, automatic feed arrangements: single roll, double roll, dial, chute, magazine and specially engineered types. Variable speed drives can be provided to allow adjustment for the optimum speed consistent with the die, material and feed length.

NIAGARA

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

GET ALL OF THE FACTS on any or all Niagara Inclinable Presses. Consult with a Niagara representative. His recommendation will be impartial. He has all types of OBI's to offer. At your request, specific Bulletins on each series, containing complete information and specifications, will be mailed to you promptly

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES:

Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

Distributors in principal U. S. cities and major foreign countries

completely equipped by Niagara for operation in your automation lines.

nished as an optional accessory.

possible range of job assignments.

A Touch here achieved so much

CHARTING THE WAY TO THE STARS...

A new iridescent point of light flashing through our skies at night will proclaim man's most radical step since the invention of the wheel. The Earth Satellite will be on course, electronically compiling information that will enable man to chart his way to the stars.

The electronic equipment will be housed in a sphere 20 inches in diameter. The sphere will be made in two parts, from a magnesium alloy, deep-drawn after spraying with 'dag'® 41, a colloidal graphite dispersion. A thin film of colloidal graphite covers the pre-heated sheets before insertion in the drawing press.

Final contour is achieved by spraying the hemisphere again with 'dag' 41; then spinning under torch heating and wood tooling until the hemisphere assumes the shape of the spin block. Both hemisphere and spin block are coated with 'dag' 41 to facilitate removal.

'dag' 41 prevents galling, scoring and metal pickup; its ease of application, film strength, lubricity and resistance to heat make it the perfect deep-drawing lubricant. Talk with your Acheson Service Engineer soon, for more detailed information, and write for Bulletin 426—Metalworking Applications. Address Dept. AM-3.

dag®

ACHESON COLLOIDS COMPANY

Port Huron, Michigan...also Acheson Colloids, Ltd., London, England

ACHESON COLLOIDAL DISPERSIONS:

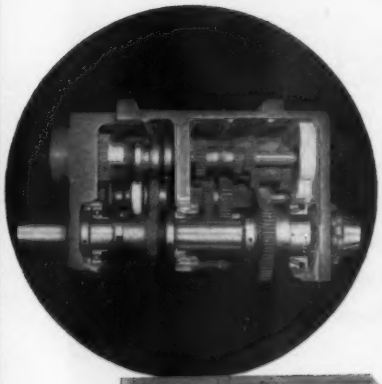
Graphite · Molybdenum Disulfide · Zinc Oxide · Mica and other solids

Offices in: Boston · Chicago · Cleveland · Dayton · Detroit · Los Angeles Milwaukee · Philadelphia · New York · Pittsburgh · Rochester · St. Louis · Toronto

better performance... greater value... are built into

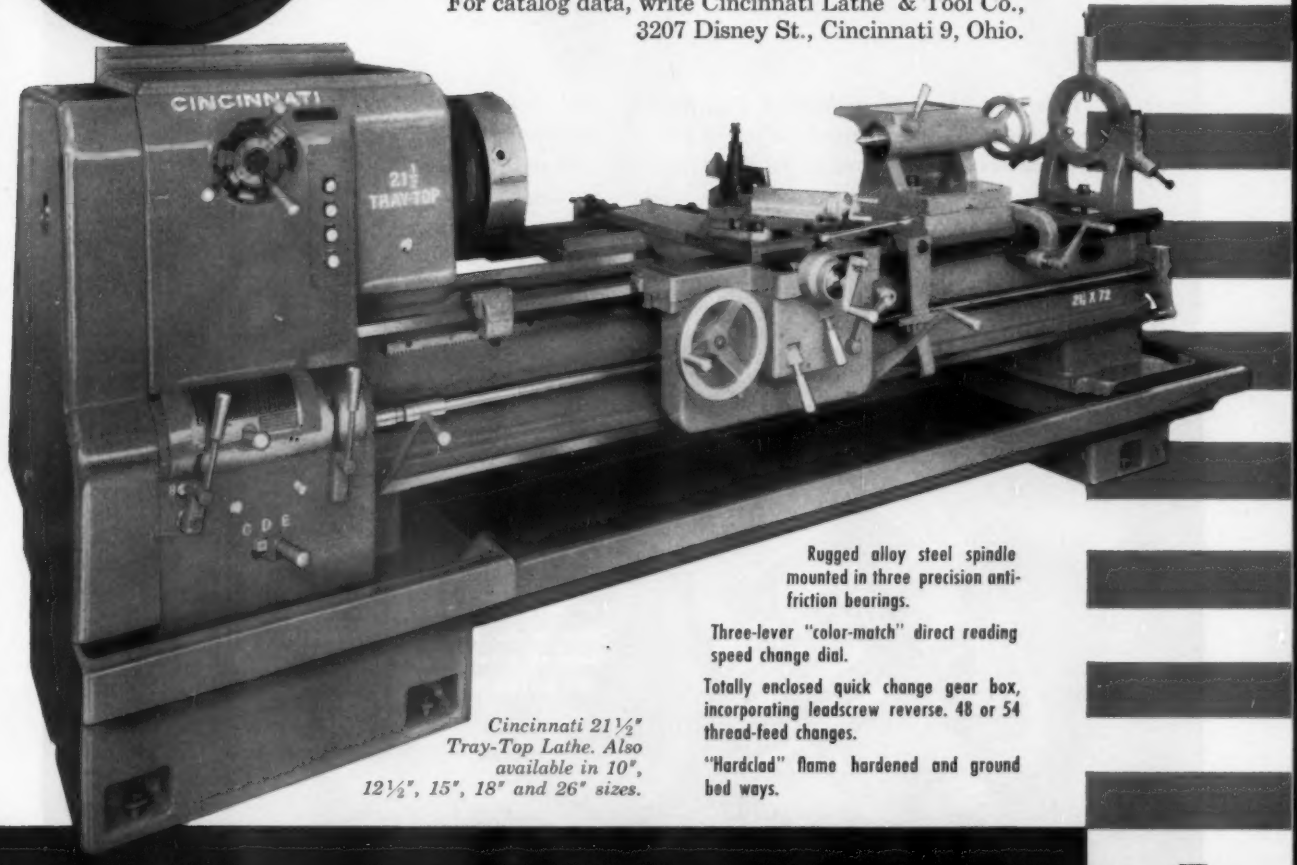
CINCINNATI
TRAY-TOP LATHES

World-famous "Cincinnati" design and engineering are fully reflected in the new Tray-Top Lathes. They incorporate precision workmanship and quality features usually associated with larger, more costly equipment.



The all-geared headstock of the Cincinnati Tray-Top provides optimum power transmission throughout all 12 spindle speeds. The speed range gives you the right combination of highs and lows to handle a wide variety of materials and diameters using all types of tools. All transmission gears and shafts are hardened for maximum service, and are mounted in anti-friction bearings.

Other advanced features of the economy-priced Tray-Top are listed below. For the complete Tray-Top feature story, see the CL &T dealer in your area. For catalog data, write Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.



Cincinnati 21½" Tray-Top Lathe. Also available in 10", 12½", 15", 18" and 26" sizes.

Rugged alloy steel spindle mounted in three precision anti-friction bearings.

Three-lever "color-match" direct reading speed change dial.

Totally enclosed quick change gear box, incorporating leadscrew reverse. 48 or 54 thread-feed changes.

"Hardclad" flame hardened and ground bed ways.

center on **cincinnati lathes and drills**

Builders of Engine, Toolroom, and Fixed Gap Bed Lathes and a Complete Line of Drilling Machines

How SKF Saved in 7 Ways

and at the same time improved its roller bearing cages by using the right

Revere Brass Strip

SKF Industries, Inc., Philadelphia, Pa., like other progressive organizations, is constantly seeking new ways to improve its products and at the same time cut production costs.

With this in mind they recently reviewed the kind of brass which was being used in their spherical roller bearing cages from the standpoints of quality and fabrication. It was then that Revere's Technical Advisory Service studied the problem first-hand and made recommendations to the **SKF** production and engineering departments.

SKF IMPROVED TYPE "C" Spherical Roller Bearing cut away to show how the cage, made of Revere Brass Strip, fits into the bearing. Due to its advanced internal design, this bearing provides greatly increased capacity and service life.

HERE IS "window-type" cage of SKF Spherical Roller Bearing, made in two pieces, one for each row of rollers. Cage is made from rugged Revere Brass Strip at the Shippensburg, Pa., plant of SKF Industries, Inc.

The result was the adoption of specification changes in brass strip as recommended by Revere which gave SKF these 7 money, time and tool-saving advantages:

1. One bore pressing operation has been eliminated. Machining is more easily accomplished. Less machining is required.
2. Tool life has been increased with some speeds increased up to 100% and feeds up to 30%.
3. Rework due to burrs has been greatly reduced. One step less is required in the deburring operation while savings through reduced cycle time for remaining deburring operations are up to 40%.
4. Chips are small now . . . there is no "angel hair" to clutter work area.
5. Life of punch used in notching roller bearing cage has been doubled. Now a run may be completed without making tool adjustments due to sharpening tools.
6. Machining speeds and feeds have been substantially increased over those in machining the former alloy.
7. Die setters report that considerable work has been eliminated in setting up the tools used.

And, all of these money-saving things were accomplished without sacrificing quality—in fact the quality of these roller bearing cages was *improved!*

This is still another eye-opening example of Revere supplying the metal that will do the best job and with the greatest economy . . . be it brass, copper or aluminum or any one of their alloys.

Why not call in Revere's Technical Advisory Service to review your operation? It may mean money saved with an improved product to boot.

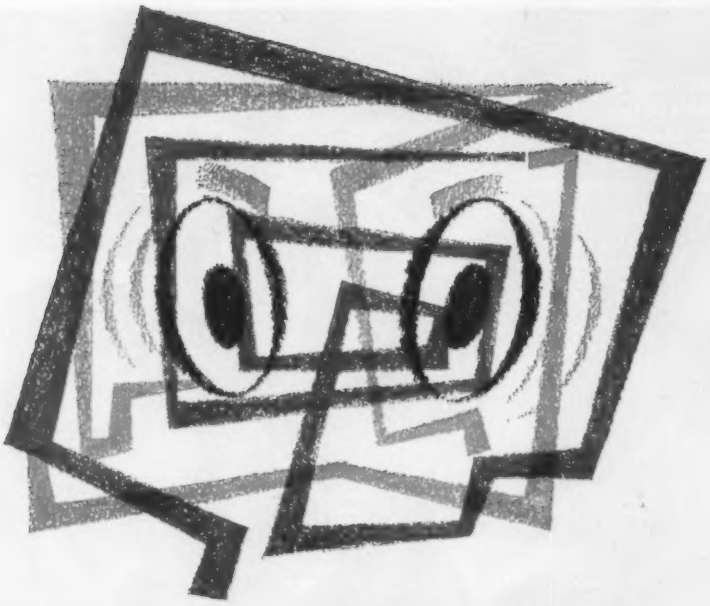
REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N.Y.

Mills: Baltimore, Md.; Brooklyn, N.Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

COPPER * BRASS * 18 01 * REVERE * ALUMINUM *



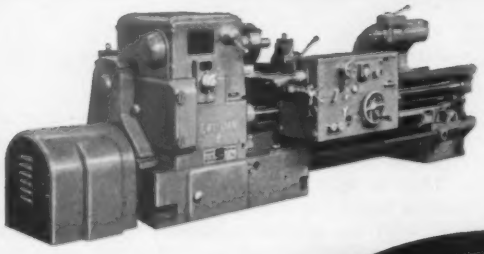
DO THREADING PROBLEMS HAVE YOU IN A MAZE?

Now you can settle the confusion of claims and counter-claims on various types of threading methods.

If you want speed plus precision, automatic efficiency plus single-point versatility, the husky, hydraulically-controlled Cri-Dan "E" is the perfect and proven solution. Or, for lighter jobs, the Cri-Dan "B" will fit right into your picture.

Before you buy any threading machine, get the *Cri-Dan* facts. Contact your Lees-Bradner distributor or write the company for complete information.

CRI-DAN



SPECIFICATIONS	CRI-DAN "E"	CRI-DAN "B"
Threading Range	2 TPI—48 TPI	6 TPI—48 TPI
Max. Thd. Dia. (Internal)*	16"	6"
Max. Thd. Dia. (External)*	12"	4"
Length Between Centers	2' 6", 5' 6", 8' 6"	36"
Spindle Speeds	50 to 1400 RPM	145 to 2800 RPM

Conditions permitting, these diameters can be extended

CRI-DAN DIVISION
The **Lees-Bradner** Company
CLEVELAND 11, OHIO, U.S.A.

Set Up for Action

Polishing wheels set up with abrasive grains and powders by CARBORUNDUM deliver quality finishes every time. For abrasives that are engineered, graded and rigorously tested to perform right to your specifications—look to the world's largest producer of crudes and manufactured grains—CARBORUNDUM. Your CARBORUNDUM Distributor or Salesman will assist you in selecting the *right* grain or powder for maximum performance at minimum cost. Ask him for Booklet 14. Or write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

Ask the man from **CARBORUNDUM** REGISTERED TRADE MARK **ELECTRO MINERALS DIVISION**

CARBORUNDUM... also makers of a complete line of Bonded and Coated abrasives

Vibration won't loosen FLEXLOC self-locking nuts

Where products must be reliable . . . must stand up under vibration, temperature extremes and hard use . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts.

HERE'S WHY:
FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting locking action. And they are reusable: repeated removal and replacement, frequent adjustments, even rough screw threads will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes, types and materials to meet the most critical locknut requirements. Your local industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 1 , Pa.

FLEXLOC® LOCKNUT DIVISION

STANDARD PRESSED STEEL CO.
SPS
JENKINTOWN PENNSYLVANIA

61 models

A machine not put to its best use is theoretically idle. Proper machine selection is an important factor in the profitable use of a multiple spindle automatic. So extensive are the demands on this type of lathe that no single model—or number of models—can be expected to efficiently handle the wide range of work available.

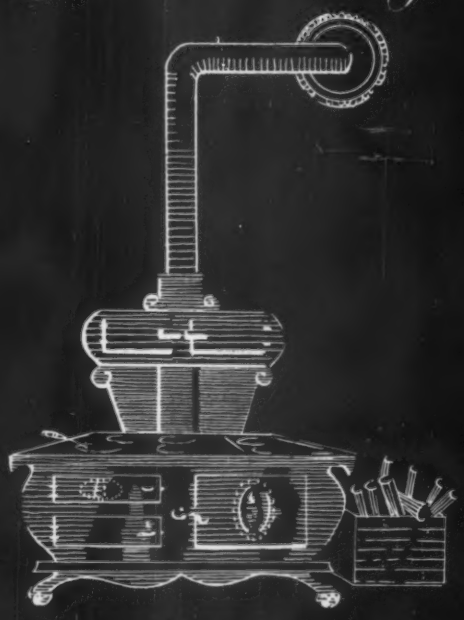
To excel in any range of work a multiple spindle automatic must be specifically designed for that range. That is why CONOMATICS are provided in so many models. In no other way can the purchaser be assured of the best possible machine for his particular requirements.

Write for your copy Today

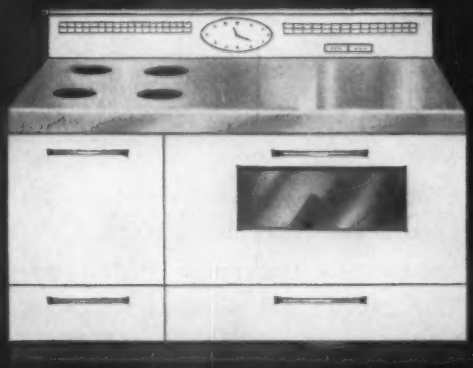
Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Great in its day...



BUT WOULDN'T YOU
RATHER HAVE THE LATEST
TECHNICAL ADVANCE?



NOW
the latest technical
advance in tools...

"Job Tempered"

HAND and POWER

Hack Saws

Certified by American Standards Testing Bureau to meet their standards for superior cutting — Uniform Teeth... Uniform Set... Uniform Temper*

FROM **Heller**

Now you can cut all kinds of metal faster *and* cheaper . . . with hand or power hack saws . . . thanks to Heller's great new advance in tool technology — JOB TEMPERING.

Controlled-analysis steel is specially selected to strict Heller specifications, then Heller uses its own *unique* heat treating method to bring every blade to the precise hardness and temper to accomplish the class of work for which it is intended.

The result: JOB TEMPERED hand and power hack saw blades perform better and last longer on the toughest cutting jobs.

Based on this new development, every Heller blade is certified by American Standards Testing Bureau* to meet the three vital requirements for superior metal cutting — *Uniform Teeth, Uniform Set and Uniform Temper.*

You can choose the right JOB TEMPERED Blade from Heller's complete line. And if your sawing problem involves economy as well as the proper use of power hack saw blades, a HELOMETER will help prolong blade life, improve cutting and speed set-ups by showing you when blade tension is precisely correct.

Big Benefits in the Heller Line of "Job Tempered" Hack Saw Blades

GIVE US YOUR TOUGHEST HACK SAWING PROBLEMS

We'll show you how the *right* Heller JOB TEMPERED Blade can solve it efficiently and economically — delivering faster, smoother, trouble-free cutting over longer periods than ever before.

HERE ARE THE FACTS!

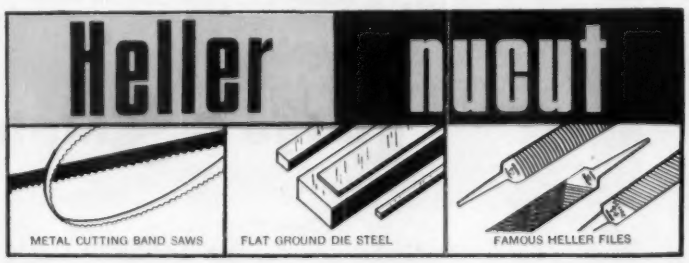
New Heller Hack Saw Catalog gives full information on sizes and types offered . . . shows why Heller JOB TEMPERED Blades, backed by the American Standards Testing Bureau*, are best in job performance.

WRITE FOR YOUR COPY TODAY.

SOLD *EXCLUSIVELY* THROUGH

Heller DISTRIBUTORS
"YOUR OUTSIDE TOOL ROOM"
Heller "Job Tempered" Tools

HELLER TOOL CO.
America's oldest file manufacturer
Newcomerstown, Ohio
A subsidiary of Simonds Saw and Steel Co.



You wouldn't cut out paper dolls with a hedge clipper!!

Then why shear 6-inch wide material with a 10-foot shear?

Cutting a small piece of light metal, plastic or rubber on a big shear is even more expensive than it is exasperating. Yet many shops, out of necessity, tie up big shears with small work.

That problem is solved by the New Lodge & Shipley 24" Speed Shear. Specially designed for fast cutting of small pieces, it has a capacity of ⅛" x 24" mild steel. Its unique work table is provided with holes which allow fast set-up of guides, templates and protractors for production of straight-side blanks at speeds up to 120 strokes per minute.

A 24" Speed Shear may easily pay for itself merely in freeing a big shear from wasteful small jobs. Investigate its possibilities in your plant. For detailed Bulletin No. PS-12, write: **The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio**

Lodge & Shipley

ALL FILES CUT... BUT ONLY DELTA FILES CUT COSTS LIKE THIS

When you pay for filing, you're paying for manhours—the labor it takes to use files. Thus, to cut filing costs you need a file that removes metal faster—you need a Delta.

Delta Files remove an average of 25% more metal in the same time with no extra effort.

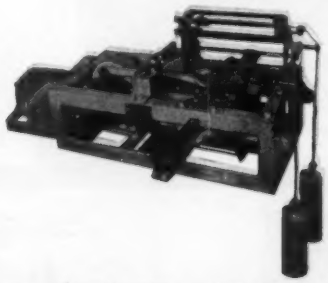
Your saving in labor far exceeds the cost of the files.

With Delta, you'll cut down your outlay for files, too.

The scientific tests that prove Delta's cost-cutting speed show that Delta Files keep cutting long after other files have lost their filing life.

Here's the reason. It's the way Delta Files are made. Each tooth is precision cut. Every one is uniform, exactly the same in height, size and shape. That means that each tooth removes its full share of metal. You get maximum filing with every stroke.

Start using Delta Files in your plant today. It's the one way you can be sure you're getting filing done at the lowest possible cost.



SCIENTIFIC MACHINE REVEALS TRUTH ABOUT FILING

It's called the Duplex File Testing Machine. With complete impartiality it measures the filing efficiency of two competing files. Every known brand of file has been tested on this machine. In many cases Delta has removed twice as much metal, outlived competing files by twice as long. Results of thousands of tests, held before accredited witnesses, show that Delta averages 25% more metal removal.

Ask your industrial Distributor for these faster-filing Delta Files

DELTA FILE WORKS, INC.

PHILADELPHIA 37, PA.

the file to choose . . . for every use **DELTA FILES®**

Precision Requires Gages

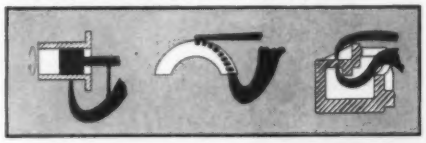
THAT'S WHY FEDERAL OFFERS

Just *any* gage is not good enough when you want to check a dimension for accuracy. Some dimensions require a higher degree of accuracy than others. And some dimensions cannot be reached directly. Still others need ranges or adjustments to give greater gage capacity.

Inside and Outside CALIPER GAGES

Ideal for measuring difficult dimensions. Specially shaped arms of various lengths can be designed to reach inaccessible spots or get around obstructions.

Odd Shaped Jaws for Unusual Applications



Limitless variety of jaw shapes permit measurements impossible with any other type of gage.

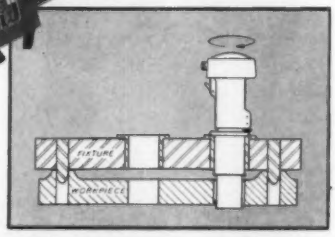
HOLE LOCATION GAGES

Series 205 Gages provide for accurately checking hole location and concentricity. Also adaptable to applications involving hole and surface relationships.

Squareness and location of holes in three mating parts of pump housing are checked to determine alignment within .0001".

Two small and one large hole are checked for parallelism with each other.

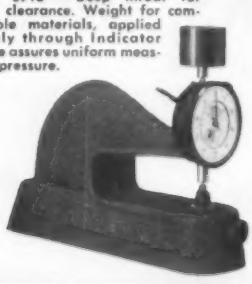
Typical Series 205 Gage (12 Basic Models)

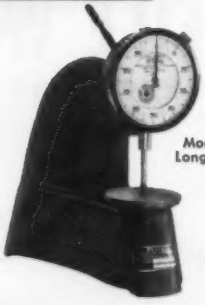


Hole location with respect to a predetermined reference and squareness of hole axis to a locating fixture.

BENCH TYPE THICKNESS GAGES and Small Comparators

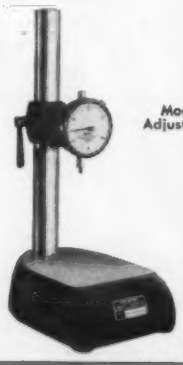
Model 691B — Deep throat for ample clearance. Weight for compressible materials, applied directly through indicator spindle assures uniform measuring pressure.



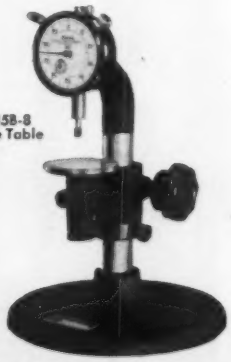


Model 57B-1
Long 1" Range

Model 35B-30
Adjustable capacity



Model 35B-8
Adjustable Table



to Suit the Job...

SUCH A VARIETY OF GAGES!

It's easy to check a dimension with a Federal Gage — and it's the quickest and least expensive way. Just call Federal and get the *right* gage for your job.

FEDERAL PRODUCTS CORPORATION
7123A EDDY STREET, PROVIDENCE 1, R. I.

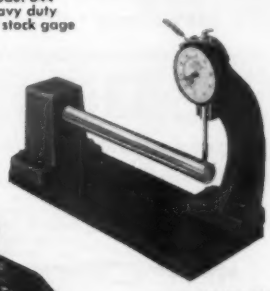
WHATEVER YOU NEED IN GAGES

Ask **FEDERAL** *First*

THICKNESS GAGES

Many styles and sizes, for portable and bench use.

Model 644
Heavy duty
sheet stock gage

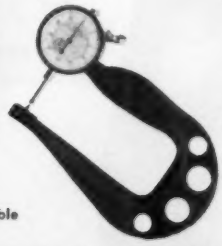


Model 22P-20
Deep Throat, Long Range

Model 22P-10

Model 26P-7
Hand-grip

Model 22P-189
Adjustable I.D.—O.D. Gage



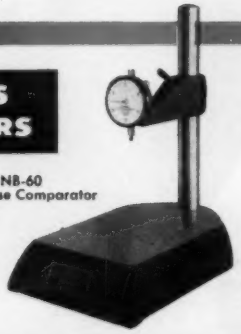
Model KB-410
Deep Throat, Adjustable

Model KP-120
Deep Throat, Portable

Model 1308
Electronic Comparator
0" to 7½"
Magnifications to 15,000x

Model 1208-1
The "Microset" Comparator
0" to 8"

OVER 10 TYPES OF COMPARATORS



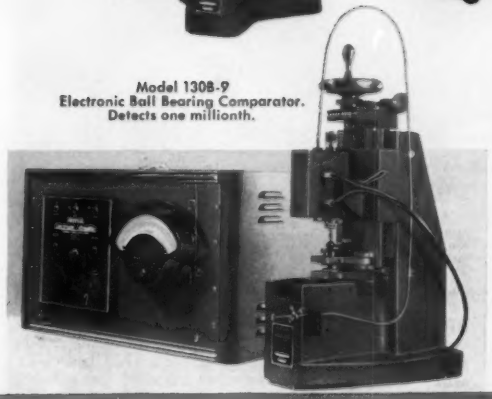
Model NB-60
General purpose Comparator

Model 136
I.D. — O.D. Electronic
Master Comparator
Detects one millionth

MANY OTHER TYPES

SEE ALSO NEXT PAGES

Model 1308-9
Electronic Ball Bearing Comparator.
Detects one millionth.



Send for Catalog illustrating world's most complete line of Dial Indicator Gages.

GAGES CAN BE SPECIALLY MODIFIED TO SUIT

GET MORE OUT OF AIR GAGING

Complete line of Attachments for

IT'S SO EASY to greatly increase the scope of Dimensionair usefulness — and do it economically by using any of the "already designed and built" Attachments. Each Attachment answers three basic requirements.

(1) Easily attached.
(2) Wide range of adjustment.
(3) Performance in keeping with quality of the Dimensionair.

Let us show you how these Attachments will give you more for your air gaging dollar. Write for Catalog 56D or ask our nearest representative to discuss applications in terms of your own needs.

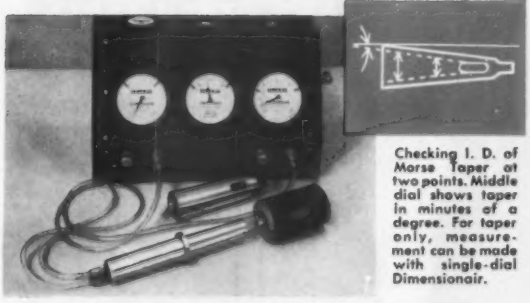
FEDERAL PRODUCTS CORPORATION
7123B Eddy Street • Providence 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

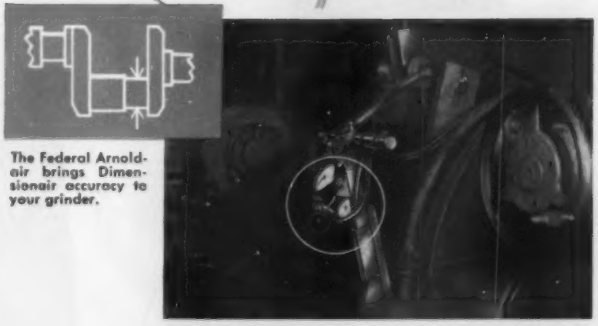
Dial Indicating, Air, Electric, or Electronic — for inspecting, measuring, sorting, or automation gaging

SEE ALSO PRECEDING PAGES



Checking I. D. of Morse Taper at two points. Middle dial shows taper in minutes of a degree. For taper only, measurement can be made with single-dial Dimensionair.

SPECIAL ATTACHMENTS AND FIXTURES
When the nature of the work or other conditions necessitate Special Attachments, Federal Engineers with their specialized gaging experience can provide the right design. Whether it's a specially designed Attachment or a modification of a regular design you can be sure it will be the best gaging Attachment for your work.

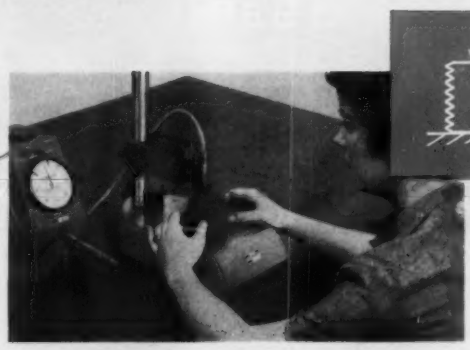


The Federal Arnoldair brings Dimensionair accuracy to your grinder.

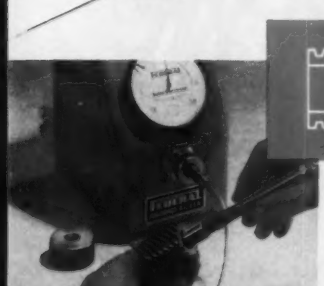
ARNOLDAIR Links the Federal Dimensionair to your Arnold Grinding Gage to provide closer operator control than is possible using a Dial Indicator alone. The Arnoldair response smooths out surface irregularities, allowing the operator to consistently grind pieces within .0001" of nominal. Easily attached to any Arnold Gage. Catalog 55A.

WITH THE DIMENSIONAIR
every measuring need

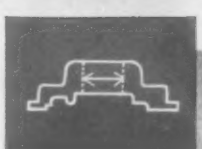
AIRPROBE Small and easily attached to many types of stock model gages. The ideal Attachment where mechanical contact is desired. Its long range per magnification and availability in .003, .006, .0015, and .0030 ranges adapt it for practically any type of gaging, thereby bringing the benefits of air gaging to more unusual types of measurement. The AirProbe is self-zeroing and, in effect, extends the measuring range of the Dimensionair with which it is used. Extremely accurate, the AirProbe is widely used when gaging slight tapers or eccentricity, out-of-roundness, or any similar conditions where a dimension changes gradually.



AirProbe mounted on regular Federal Comparator in place of a Dial Indicator to economically provide greater sensitivity and extreme accuracy.



The extra clearance on Federal Air Plugs makes them faster and more convenient to use . . . also increases their life.

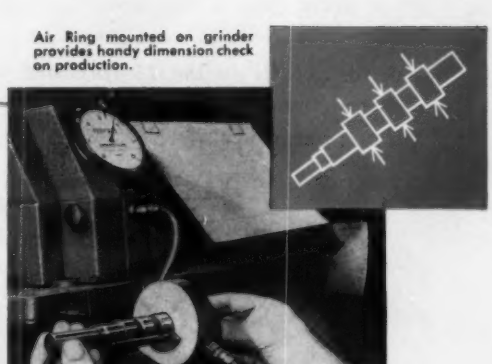


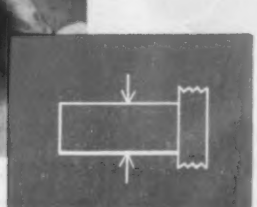
Quickly attached Air Bore Gage checks diameter to .00005" accuracy.

ADJUSTABLE AIR BORE GAGES Light and well balanced, only four gages required to cover all measurements from ½" to 8". Concentricity of centralizing contacts with the measuring contacts is so precise gage can be set with gage blocks or micrometer instead of a special master. Centralization remains accurate even though gage is cocked laterally, and is maintained throughout the capacity of the gage.

AIR PLUGS Furnished in various types . . . Through Hole, Counterbore, and Blind . . . and having one, two, three, four, or six jets as required. Available from .125" diameter, up. The jet faces are set lower in the plug and provide greater protection against damage: air jets are larger and less easily clogged. Plugs are available from stock in many sizes.

Air Ring mounted on grinder provides handy dimension check on production.

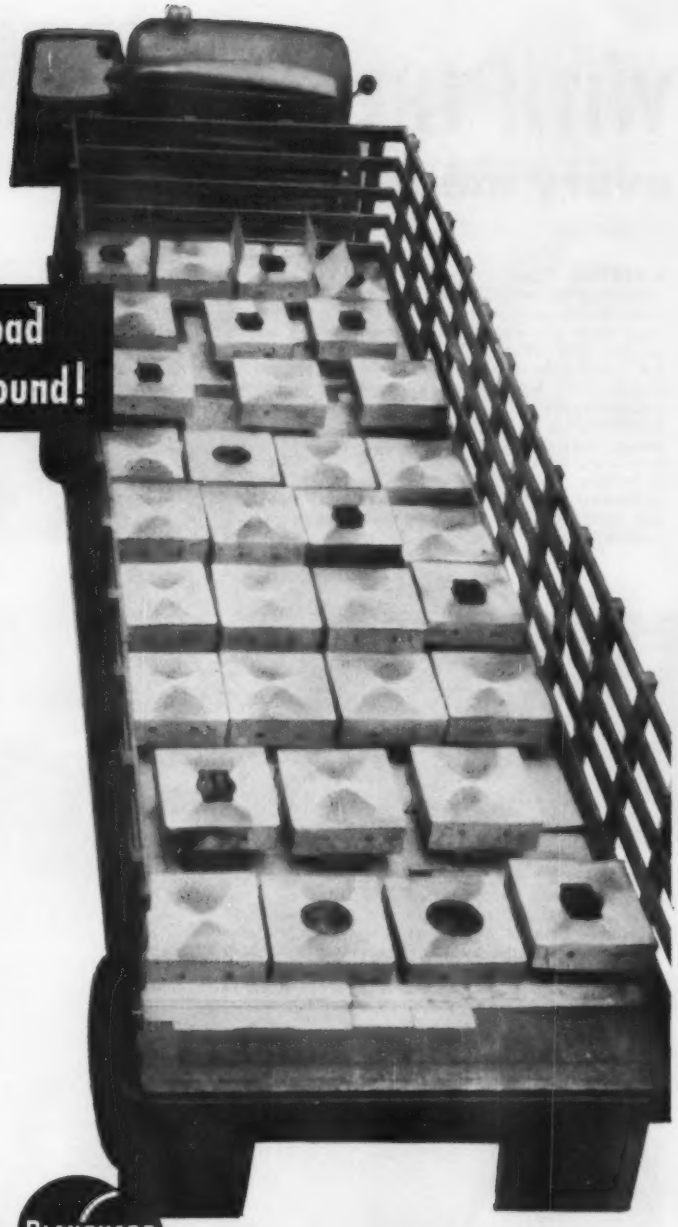




Air Snap in bench stand checks size of drill jig bushing.

ADJUSTABLE AIR SNAPS Unexcelled for accuracy and precision. Made in five sizes, 0" to 6", each having a wide range of adjustment. Anvils are precision lapped, and remain flat and parallel throughout entire range of adjustment. Does not disturb the regular Dimensionair calibration: (.003" at 2500:1 magnification.) Self-zeroing so that only a single master is required for setting to size. Can be used portably or mounted as a bench comparator.

AIR RINGS Regularly furnished with two or three jets. For special applications, can also be furnished with one, four, or six jets. Air jets are larger and recessed farther below the surface than those in competitive makes. This helps eliminate clogging and greatly reduces wear or abrasion. The addition of guide chutes as shown permits parts to be passed through the ring quickly. Rings are regularly available with inside diameters from .250" up to and including 3.010". Larger sizes can be supplied on application.



Precision by the Truckload - - they're Blanchard ground!

This truck is loaded with 14 tons of steel. Its cargo is 33 soft steel plates, each measuring 27½" x 25½" x 11.125", and ground to ± .001" on a Blanchard Surface Grinder.

Dies up to 84" across corners, can be ground on a Blanchard at great savings. Grinding can be controlled without guesswork—leaving a flat, sharp die—as soon as the entire surface is cleaned up. Die resharpening on the Blanchard allows you to get maximum life from your valuable dies and end plates.

Ask for details on the 15 standard Blanchard models.

For best results in surface grinding . . .

PUT IT ON THE BLANCHARD

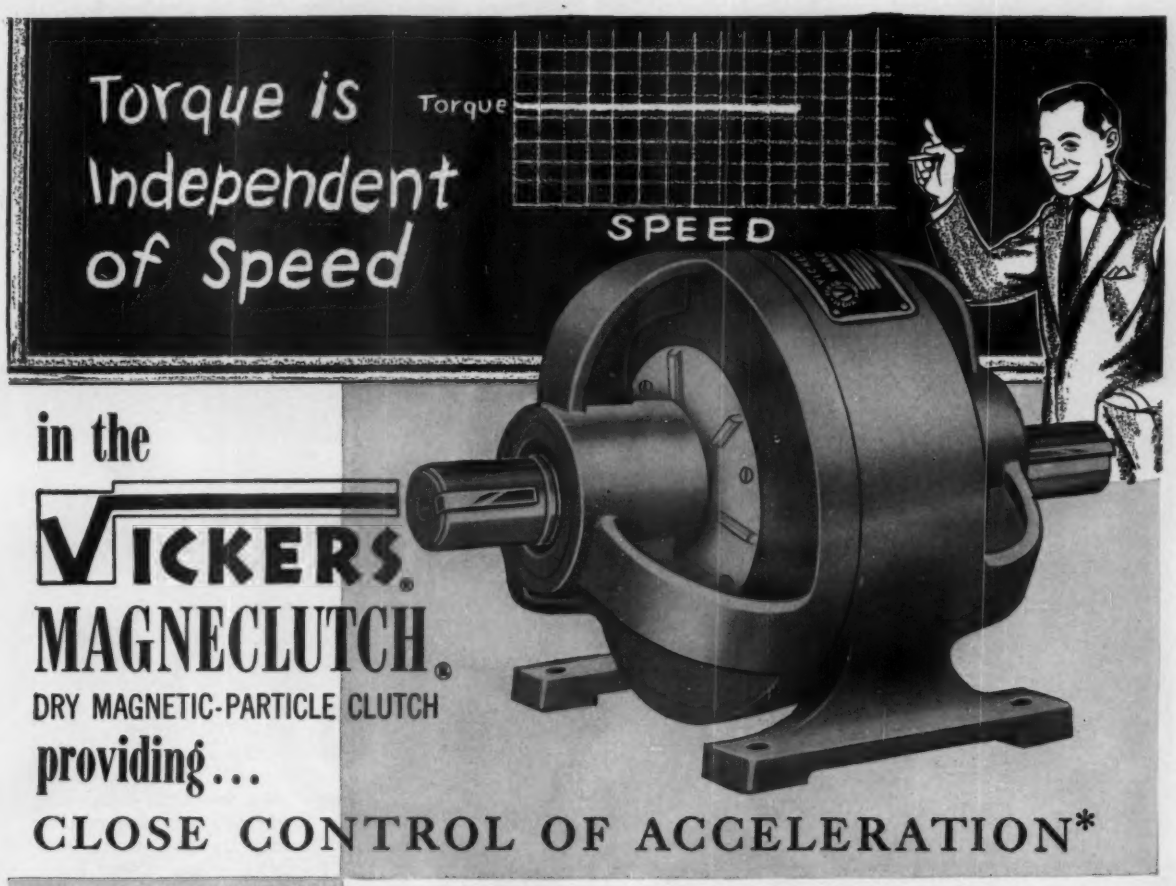
THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS.

THE BLANCHARD MACHINE CO., 64 State St., Cambridge 39, Mass.

Gentlemen: Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd edition) and "Work Done on the Blanchard" (5th edition)

NAME_____ STREET_____

FIRM_____ CITY_____ ZONE____ STATE_____

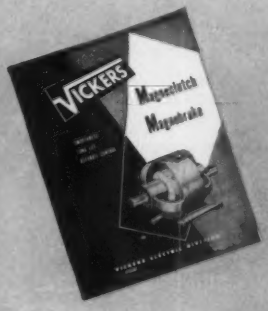


in the VICKERS® MAGNECLUTCH®

DRY MAGNETIC-PARTICLE CLUTCH

providing...

CLOSE CONTROL OF ACCELERATION*



Vickers MAGNECLUTCH may also be used for braking and tension control. Get the complete facts. Write today for bulletin and application data forms.

IN the Vickers MAGNECLUTCH, torque is transmitted through the linking action of magnetized ferromagnetic particles in the gap between driving and driven members. The amount of torque transmitted is regulated by varying the amount of energizing current, and is independent of the rotational speed of the driving and driven members. This torque transmission principle permits extremely close control of acceleration.

VICKERS MAGNECLUTCH

Also Offers These Other Outstanding Advantages

SMOOTH OPERATION
LONG LIFE, *because there's no wear on torque transmitting surfaces*
TORQUE AT ZERO SLIP—*torque transmitted with 100% mechanical efficiency*
EXTREMELY FAST RESPONSE
SMALL CONTROL POWER
EASILY ADAPTED TO REMOTE CONTROL

*Equally close control of deceleration may be obtained with Vickers MAGNEBRAKES.

VICKERS ELECTRIC DIVISION

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How Can Any Hack Saw Cut As Fast As a MARVEL?

GREATER EFFECTIVE FEED PRESSURE

MARVEL Series 6, 6A, 9 and 9A Hack Saws are capable of automatically applying *more than twice the feed pressure* required for most hack sawing jobs. This means that MARVEL Saws can utilize the full strength and heat resistance of the modern composite hack saw blade which is designed to cut most efficiently under heavier feed pressures. MARVEL Dual Power Feed forces the blade to cut as deeply as possible and **practical** on every stroke—to cut-off the work in the fewest possible strokes by automatically adjusting the feed pressure in relation to the changing work resistance.

MORE CUTTING STROKES PER MINUTE

MARVEL Reciprocating Crank Lever Action, providing quick return of the saw frame on the non-cutting stroke produces 33⅓% more *cutting strokes* per minute than ordinary saws *without increasing the peak blade velocity on the cutting stroke.* Result: faster cutting-off without damage to the blade.

With far greater feed pressures automatically available, plus more cutting strokes per minute, is it any wonder that MARVEL Series 6 and 9 Hack Saws will give you faster, accurate cutting-off every time?

Write for the MARVEL Catalog and the complete story on MARVEL Metal Cutting Saws

ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

S-1301

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades

If you use reamers as fast as machine guns use bullets...

This brand cuts down your reamer usage, production time and costs!

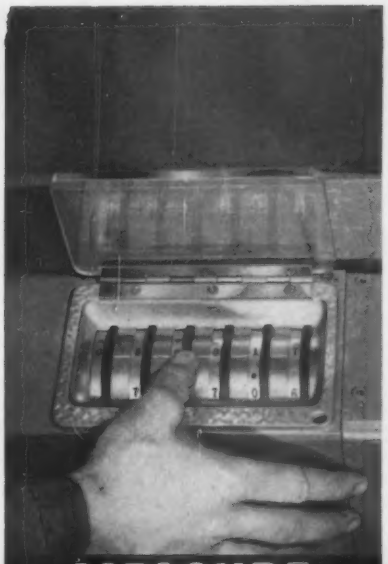
The more reamers you use, the more you need Union

Union also manufactures drills, end mills, milling cutters, hobs and carbide tools. Available nationally through Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco. *S. W. Card Division*, Mansfield, Mass.; *Butterfield Division*, Derby Line, Vermont.

UNION

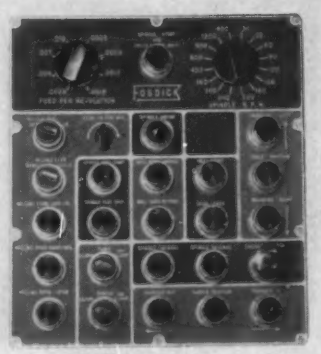
TWIST DRILL COMPANY, Athol, Massachusetts

See Your UNION DISTRIBUTOR for cutting tools that will save you time and money



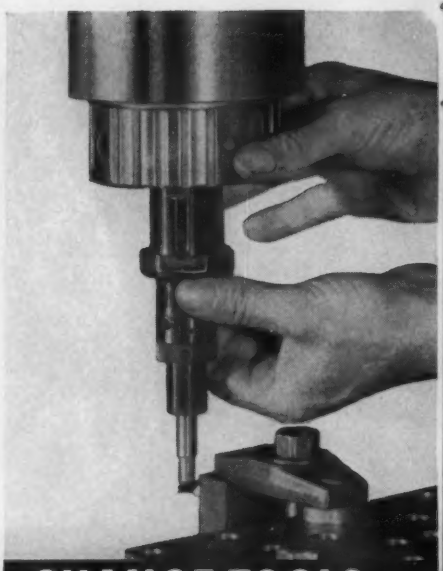
MEASURE

Dial dimension direct from print. There are two sets of direct-reading drum dials, one for longitudinal, the other for transverse position. Operator simply sets dials so that numbers on dials correspond with numbers on blueprint. Simple. Direct. Precise.



POSITION

Press two buttons, one for longitudinal, one for transverse positioning. Table, and work, are automatically positioned, and clamped under the tool, accurate to ± .0001"! Accuracy is dependent upon highest-quality gages, not upon screw threads. Sensitive .0001 Dial Indicators maintain a positive check at all times.



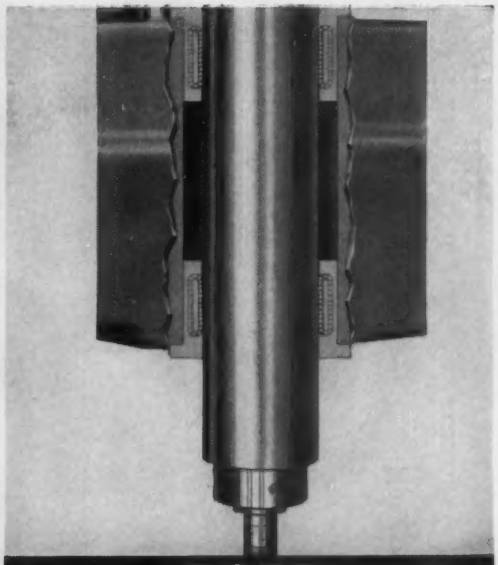
CHANGE TOOLS

Tool changing takes less than 10 seconds, with BF spindle. Can be accomplished while table is positioning. Hole sizes are repeated within ± .0001", without resetting tools! High-precision tool holder is built right into the spindle of the Jig Borer. Adapters accommodate both standard and special-sized tools.

FOSMATIC JIG BORER

AUTOMATIC POSITIONING

DIRECT DIMENSION MEASURING



BORE

Push-button precision boring. For finish boring, change tools quickly, then bore at touch of button. The hardened alloy steel quill rides on 800 preloaded balls mounted in precision bushings located permanently at top and bottom of head—as close as possible to spindle nose for maximum rigidity. Spindle is guaranteed not to exceed .0002″ runout at the end of 12″ proving bar!

MEASURE - POSITION - CHANGE TOOLS START BORING . . . ALL IN SECONDS!

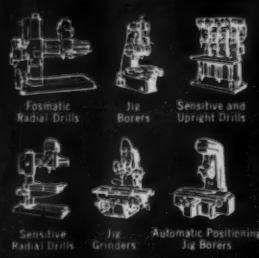
hole size and position accurate to ± .0001.

The new Fosdick Jig Borer can be used for the finest toolroom boring or for production of precision holes. Like the scores of Fosdick Jig Borers in plants throughout the United States, this machine will perform consistently to ± .0001″ . . . in measured table and saddle position as well as hole size.

The Fosmatic Jig Borer is extremely simple to operate. Changing of feeds and speeds, all movements of the table, saddle, and head can be accomplished by push button. Spindle is started and stopped by lever on head. Machine may be equipped with or without automatic positioning. Can be equipped for numerical control with either tape or card systems.

Other features available as extra equipment include Milling Feed, Rapid Traverse to Quill, coolant system and reversing motor for tapping.

Ask for Fosmatic Jig Borer Bulletin, JB-A.



NEED DRILLING EQUIPMENT?
GET A PROPOSAL FROM FOSDICK!

FOSDICK

THE FOSDICK MACHINE TOOL CO.
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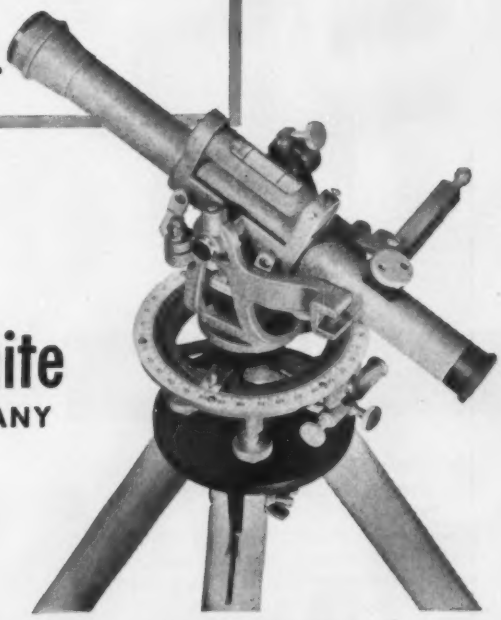
There's a Good Reason why

ZINC DIE CASTINGS

are so widely used . . .



at David White
INSTRUMENT COMPANY

IT'S

ACCURACY

You may never need a theodolite, but you will recognize the importance of accuracy in this surveying instrument. This is the tool that enables engineers to build bridges and tunnels from both ends and make them meet exactly in the middle. It also helps surveyors lay out highways and property lines. Any instrument demanding such precision must be made of very accurate parts. ZINC Die Castings are meeting that need.

Engineers at David White Instrument Company have a strong preference for ZINC Die Castings because of the consistent accuracy and other physical and mechanical properties required in their transits and levels. They find that zinc has greater resistance to shock than metals formerly used. ZINC Die Castings are also much less expensive for quantity production and greatly reduce the assembly and finishing problems.

Many manufacturers are recognizing the important quality of ACCURACY that can be obtained with ZINC Die Castings. Any die caster will show you samples of such precision work done for his customers. It may be that these examples will suggest improved qualities and cost savings for your products.

THE NEW JERSEY ZINC COMPANY 160 Front Street, New York 38, N. Y.

The research was done and the Zamak die casting alloys were developed with

HORSE HEAD SPECIAL (99.99 + % Uniform Quality)

ZINC
FOR DIE CASTING ALLOYS

BUHR
ECONOMATIC
sets
precedent . . .

BUHR ECONOMATIC

pace-setting feature—combining rough and finish milling of port faces with subsequent operations, in one machine.

Other features of this BUHR ECONOMATIC

- parts may be banked between the two sections to minimize downtime during tool changes
- central graphic control panel
- exclusive Buhr detector system in main console
- J.I.C. Standards throughout
- special Buhr sectional-base construction to facilitate future part-changes
- standard and special parts interchangeable for ease of maintenance
- spindles arranged for pre-setting of cutting tools
- hardened and ground steel ways
- central mist-lubrication on all heads
- automatic lubrication of all moving parts
- automatic probing stations

BUHR
ECONOMATIC

setting
the pace
in modern

ECONOMATION

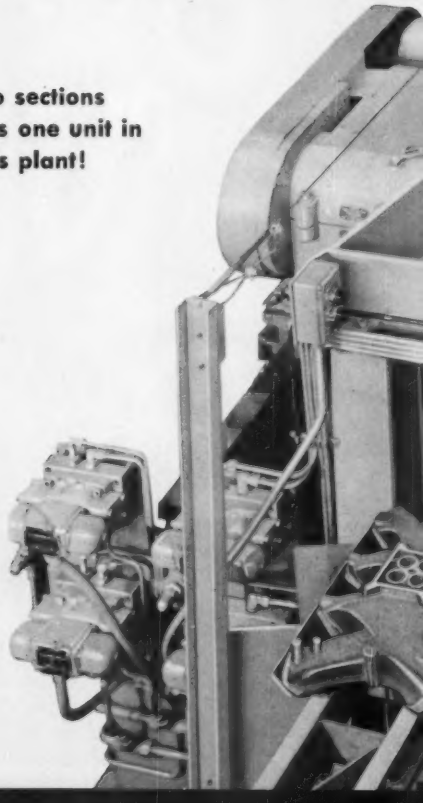
"ECONOmical
autoMATION"

sets precedent by complete machining of in
. . . from rough casting to fi

78 operations performe

ROUGH FINISH ROUGH

These two sections operate as one unit in customer's plant!



BUHR MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers

f intake manifold
o finished part in 38 seconds!

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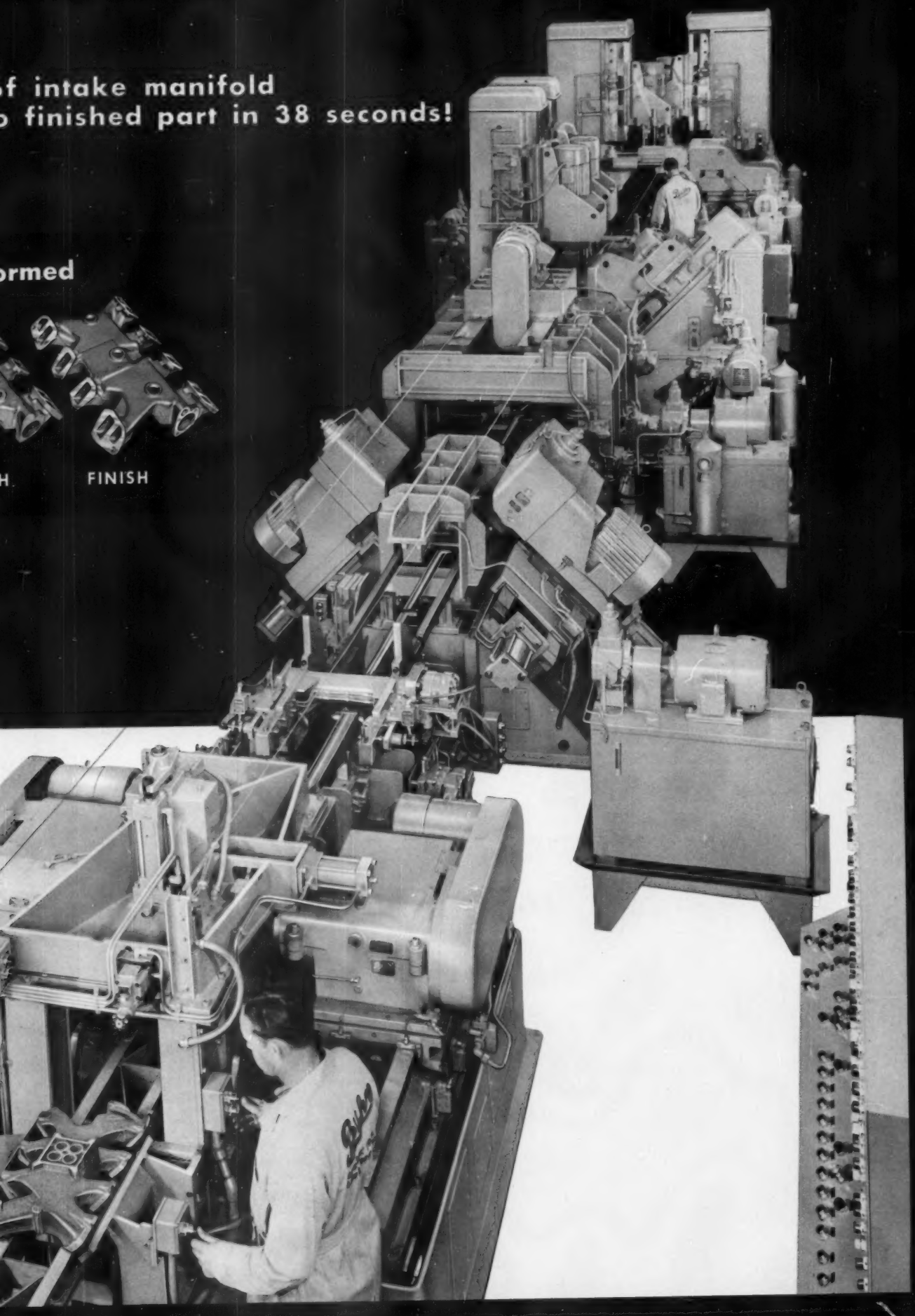
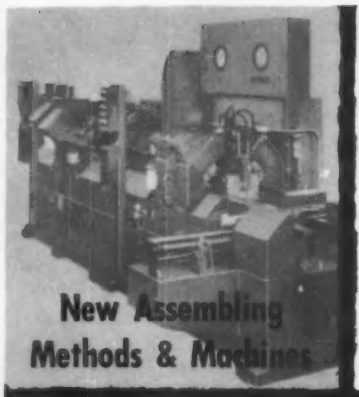
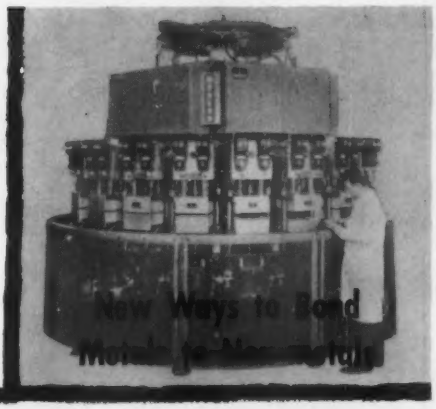
H FINISH





New Assembling Methods & Machines

New fast functional chamfering of almost any kind of part



New Ways to Bond Metals to Non-metals

Complete Deburring & Chamfering

with

Burr-Masters

For all kinds of innovations in

New Machines to Cut Your Costs

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Industrial Engineering Co.

Positive deburring of any toothed part at 5 teeth/second

All Kinds of Multi-station Machines

Positive deburring of non-toothed parts

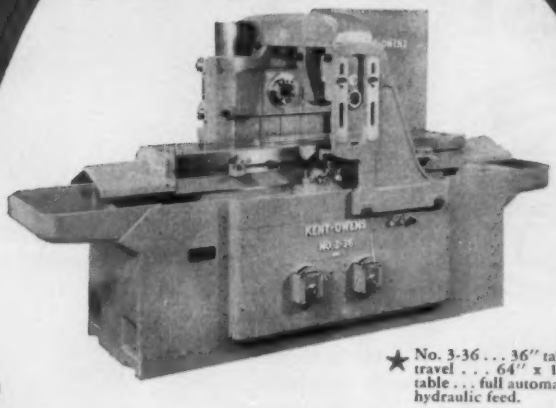
New Types of Burr-Blasters

New machines for non-machining operations on machined parts

Automated Pressure-Testing

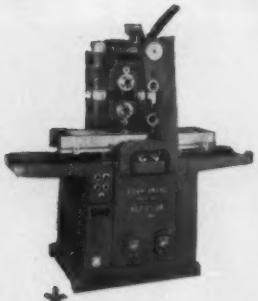
Every one a Star

for speedy accurate milling!



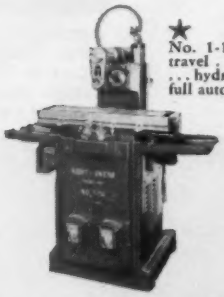
★ No. 3-36 . . . 36″ table travel . . . 64″ x 16″ table . . . full automatic hydraulic feed.

★ No. 2-20 . . . 20″ table travel . . . 42″ x 12″ table . . . full automatic hydraulic feed.

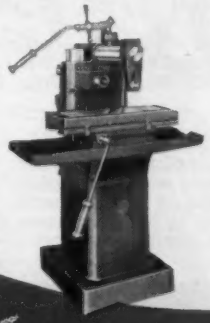


★ No. 2-20DS . . . Double Spindle for two milling operations . . . 20″ table travel . . . 42″ x 12″ table. Hydraulic feed.

You'll turn out milling jobs with stepped up speed and accuracy with the work on Kent-Owens Machines! These extra-rugged Millers are performance-proved . . . simple . . . versatile . . . practical in every detail. Advanced features throughout! Twin-post head mounting assures balanced load. Only two gear contacts, motor to spindle, means greater cutting efficiency. Check your needs! Write today for bulletins on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines. Kent-Owens Machine Co., Toledo, Ohio.



★ No. 1-14 . . . 14″ table travel . . . 32″ x 9″ table . . . hydraulic table feed . . . full automatic cycle.



★ No. 1-M . . . Hand feed to table and head . . . 25″ x 9″ table travel . . . head counter-balance is adjustable.

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KENT-OWENS

for milling machines

KENT-OWENS REPRESENTATIVES

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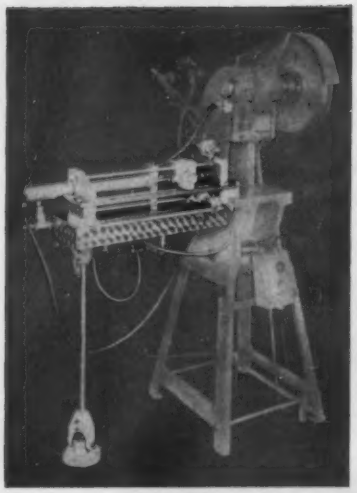
IMPROVE YOUR PRESS-ROOM PRODUCTION WITH THESE

U S PRODUCTS ★



Left: ASF-12 U. S. Air-Operated Slide Feed used in conjunction with small OBI Press. On light work requiring long pitch or feed length, this type of Feed can be used with presses much smaller than would ordinarily be required.

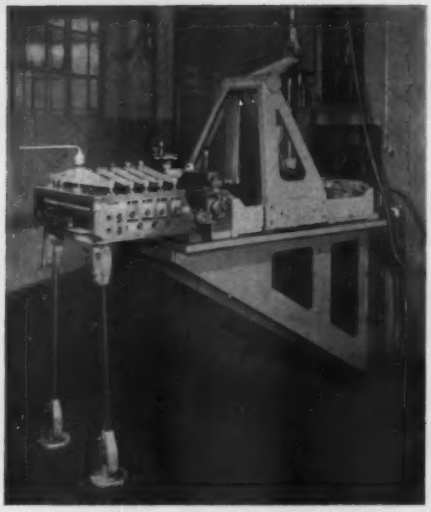
Gain all the advantages from the use of coil stock in your Press Room by arranging your presses with automatic equipment. The illustrations show just a few of the many units included in the line of U. S. Automatic Press Room Equipment designed and built to aid you to reduce costs and increase production. Every operation eliminated will increase your profit potential and place you in a more favorable position in today's competitive market.

Investigate! Ask for copies of Bulletins 80-A and 95-A.

U. S. TOOL COMPANY, INC.

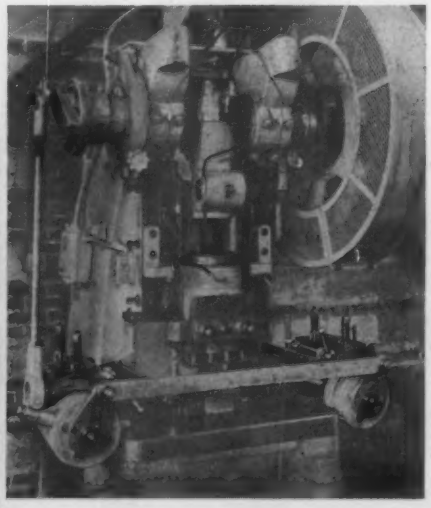
Ampere (East Orange) **New Jersey**

★ **U. S. PRODUCTS** — Slide Feeds — Roll Feeds — Plain and Power Driven Straighteners — Plain and Power Driven Stock Reels — Coil Cradles — Combination Cradles and Straighteners — Stock Oilers and Wipers — Scrap Choppers — Die Sets — Multi-Slides® — Multi-Millers®

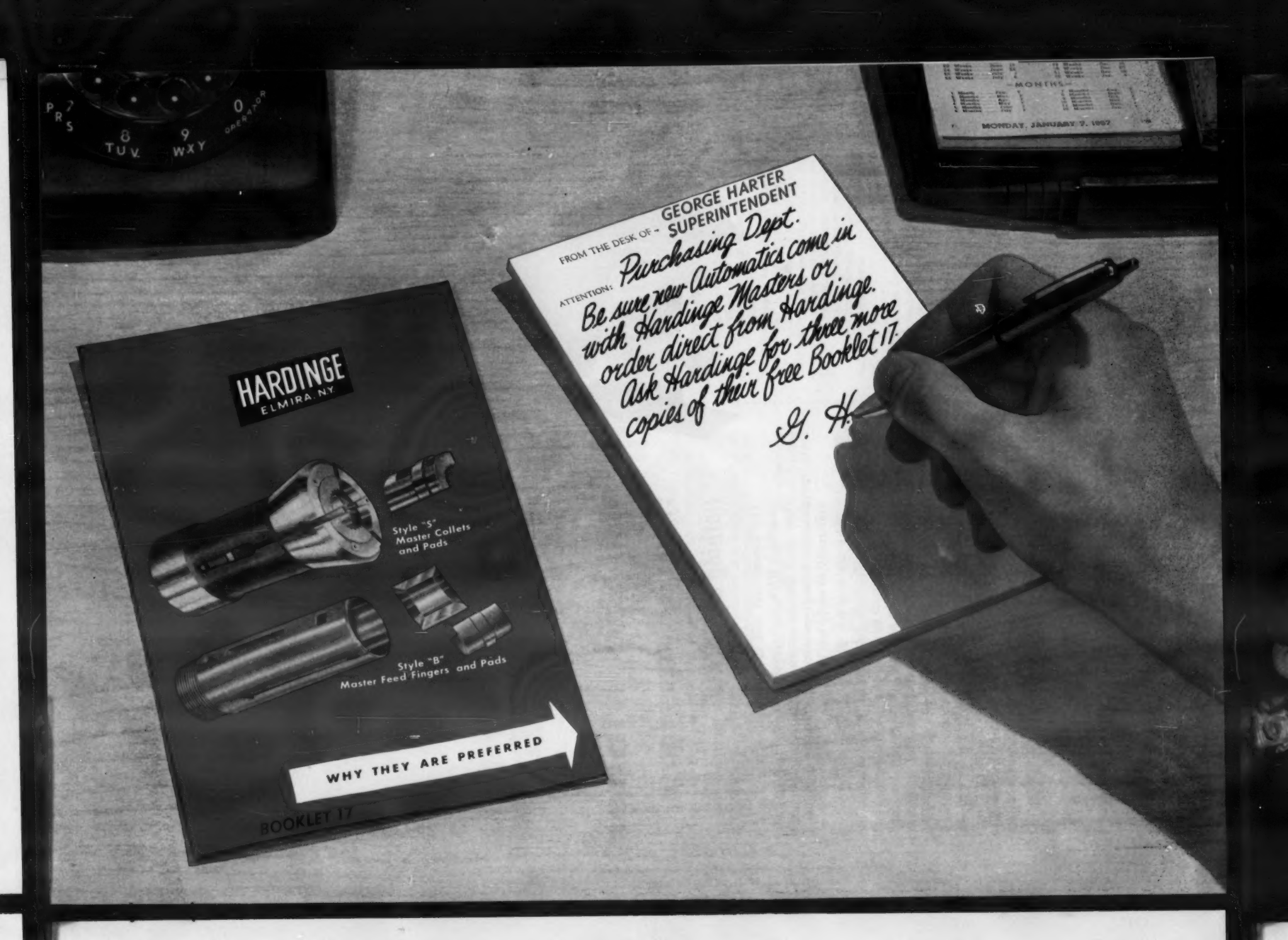


Above: SF-24-24 U. S. Slide Feed equipped with Plain Straightener mounted on Straight Side Press. Capacity for material up to 24" in width, feed length adjustable up to 24" per stroke. Same type of Feed made in smaller sizes.

Below: SFC-24-24 U. S. Cabinet-Mounted Motor-Driven Slide Feed equipped with Plain Straightener. Capacity for material up to 24" in width, feed length adjustable up to 24" at one stroke. Equipped with counter to permit multiple stroking to obtain longer lengths.



Left: U. S. Double Roll Feed (push-pull type) mounted on conventional OBI Press. Direction of feed can be either right to left or left to right. Made in range of sizes.


HARDINGE
ELMIRA, N.Y.
Style "S" Master Collets and Pads
Style "B" Master Feed Fingers and Pads
WHY THEY ARE PREFERRED
BOOKLET 17
FROM THE DESK OF - GEORGE HARTER
SUPERINTENDENT
ATTENTION: Purchasing Dept.
Be sure new Automatics come in with Hardinge Masters or order direct from Hardinge. Ask Hardinge for three more copies of their free Booklet 17.
G. H.
MONTHS
MONDAY, JANUARY 7, 1957

still the winner

...and in high speed steels, nothing beats REX

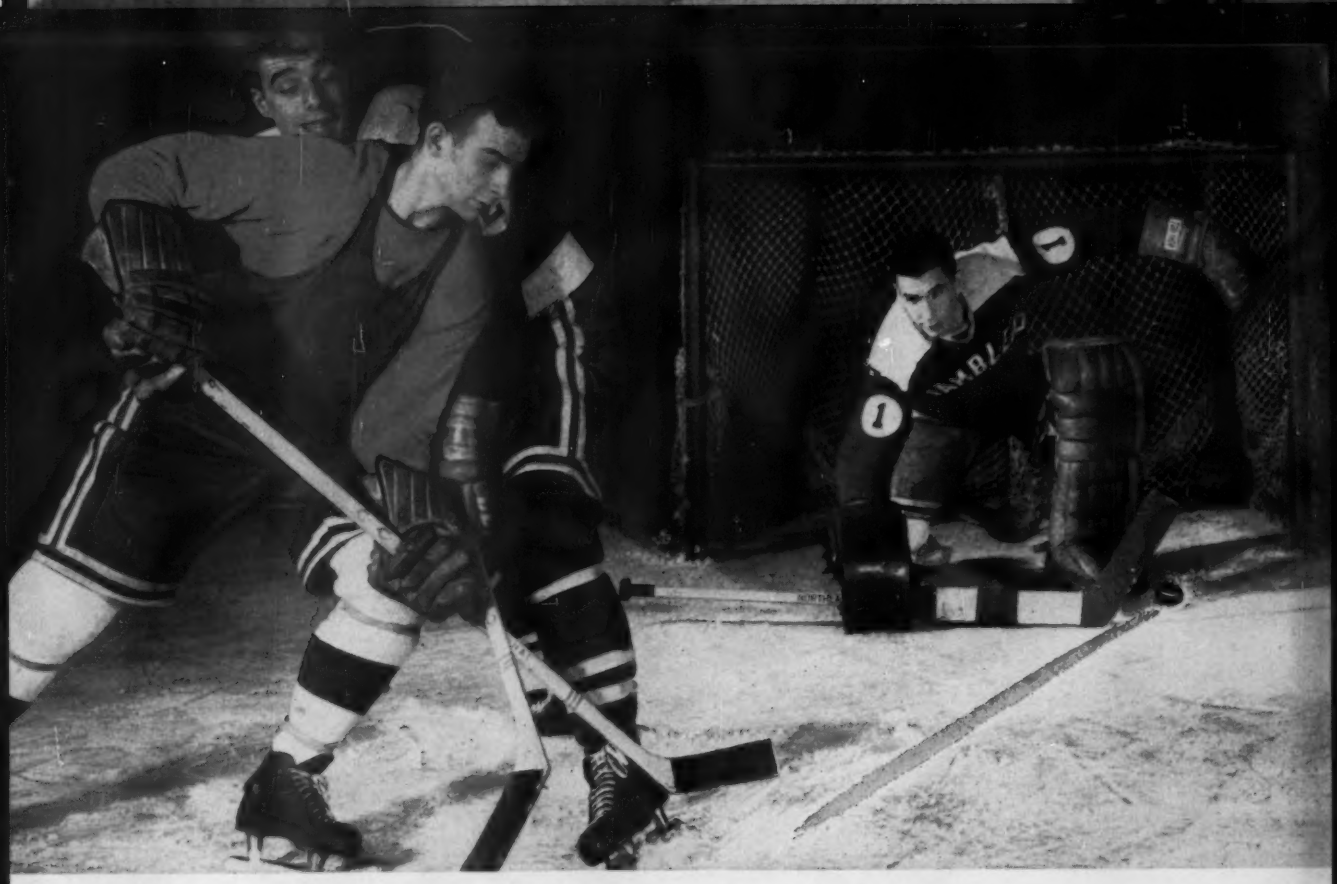
The winner and still champion after fifty years is Crucible's REX high speed steel. *And now it's better than ever!* Recent improvements in manufacturing processes have given even higher quality and greater uniformity to every one of its properties.

Why not shop test the new REX yourself? Test it for size, structure, response to heat treatment, fine tool performance. Give it any test you wish. You'll see why it is today, as it has always been — *the standard by which all other high speed steels are compared.*

Ask for REX by name at your local Crucible warehouse. Or order it directly for prompt mill delivery. And for information on REX, and the other Crucible special purpose steels, send for the *Crucible Publication Catalog. Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



Winner by three points!

The goals are always in *your* favor when you have CIMCOOL° Concentrate on the job in your plant. Here's why CIMCOOL leads the league—actually is the largest selling chemical cutting fluid in the world—winning by three big points:

CIMCOOL LOWERS COSTS because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.

CIMCOOL DOES A BETTER JOB because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.

CIMCOOL IS CLEAN, doesn't soil hands or clothing. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

So get in the winning column. See your CIMCOOL distributor. He'll give you full information on *all* the advantages of CIMCOOL Concentrate—as well as details on the entire family of CIMCOOL Cutting Fluids.

Or contact us direct and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL Concentrate—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL Tapping Compound—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT Concentrates — For jobs requiring oil-base cutting fluids. Added to mineral oils, they give economical mixes for higher speeds and feeds.

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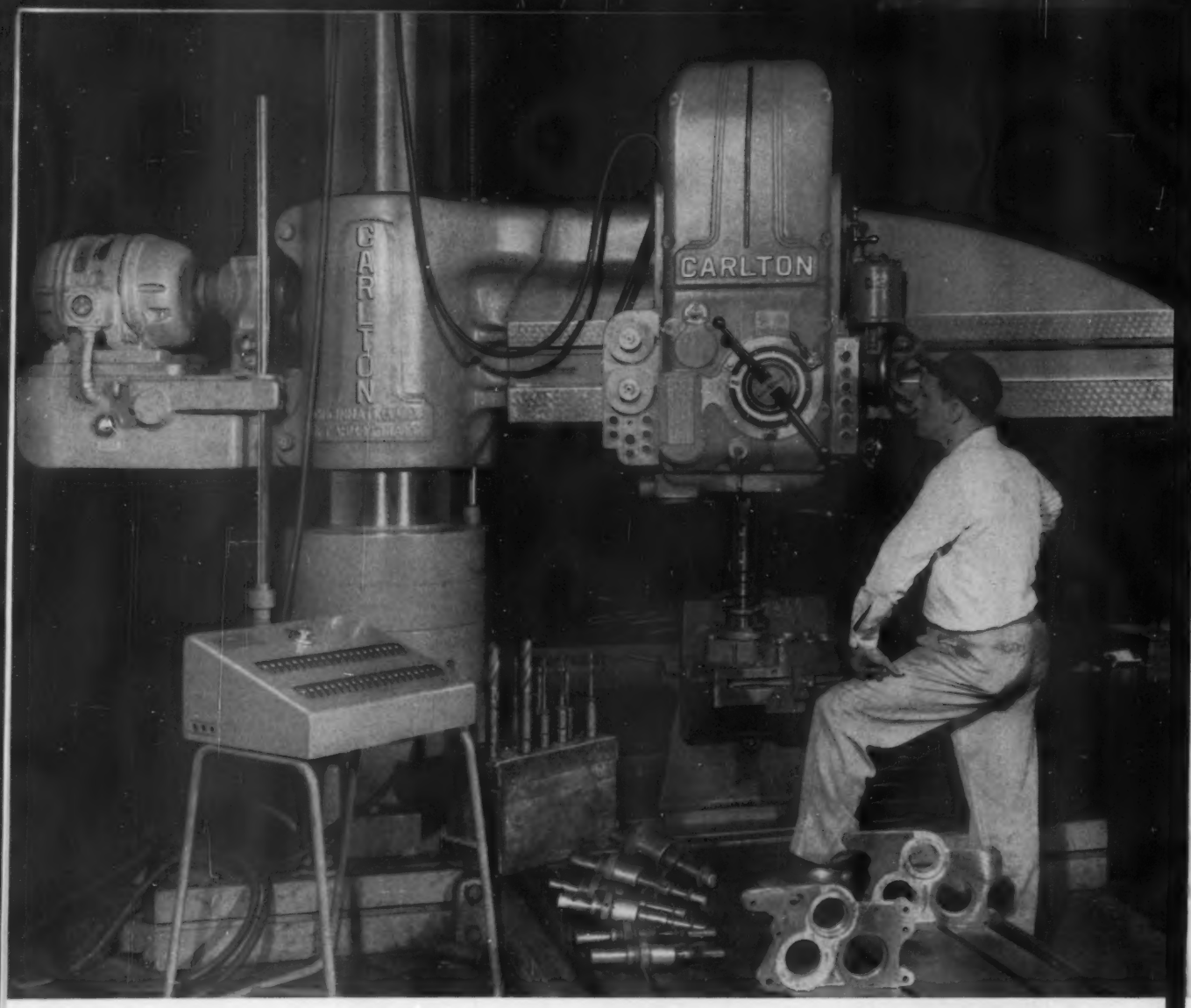
CIMCOOL Machine Cleaner — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

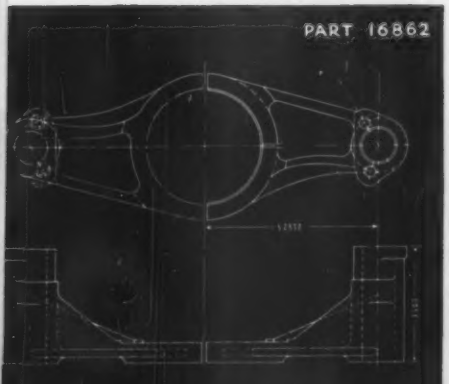


Programmer-preselector speed-feed control for Carlton radial drills registers big savings when used under the proper conditions.

The study described below proved that maximum drilling efficiency depends on having the right speed-feed control for every requirement.

PROGRAMMING CUTS DRILLING COSTS 19%

Carefully timed and observed production runs in Carlton plant demonstrate real savings with programming and preselector devices



An extensive 3-month study under actual factory operating conditions has proved conclusively that Carlton programming and preselector units make substantial savings over manually controlled radial drills.

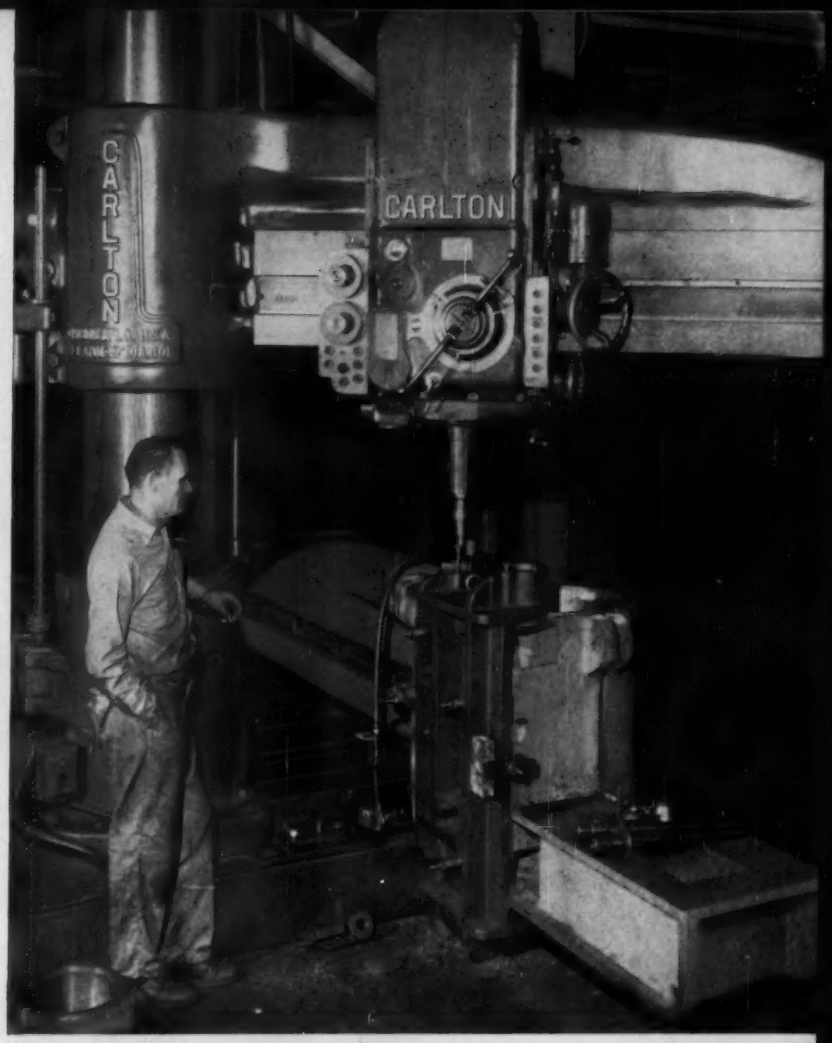
During the study 28 different parts were drilled in two separate groups: one on a manually controlled radial drill, the other on radial drills controlled by a preselector or by programmer-preselector combination.

Accurate time studies were kept on the 56 lots. Quantities ranged from 3 to 42 parts in a lot. Drilling operations varied from very simple, requiring only 12 minutes set-up and machining time each, to very complex, requiring over two hours set-up and machining time each.

Results indicated savings on the programmer-preselector combination as high as 23%, with the preselector controlled machine showing only slightly lower savings.

Programming console may be pre-set by clerical personnel, using data computed by tool engineering department.

Preselector controls built right onto headstock. Speed-feed settings are made on two large, easy-to-read dials.



Preselector control allows the operator to plan one step ahead, and to set the speed-feed for the next operation while machine is still under cut.

Average time saved in set-up and machining was 19% . Typical of this group was part 16862, the gear shifter shown at left. When 30 parts were drilled on the manually controlled machine, it took 13 hours to complete the lot, or 25.8 minutes per piece. Contrast this with 10.6 hours to drill the 30 parts on a programmer-preselector controlled radial drill, and you have a savings of almost 5 minutes per piece, or 2 hours 24 minutes for the lot.

The study also demonstrated the need for a wide choice in speed-feed controls. The program controlled radial drill was as inefficient on some parts and lots as the manually controlled unit was on others. Drill requirements will naturally vary from shop to shop. However, when there is a choice of preselector, programming, or manual control, it's much easier to obtain the control best suited to each condition.

The programming device is ideal for a highly complex part requiring many drilling operations. It's most efficient where the tool engineering department pre-determines the correct speed and feed for each of several drilling operations in an entire program. The Carlton program console is arranged with 20 or 30 operation stations.

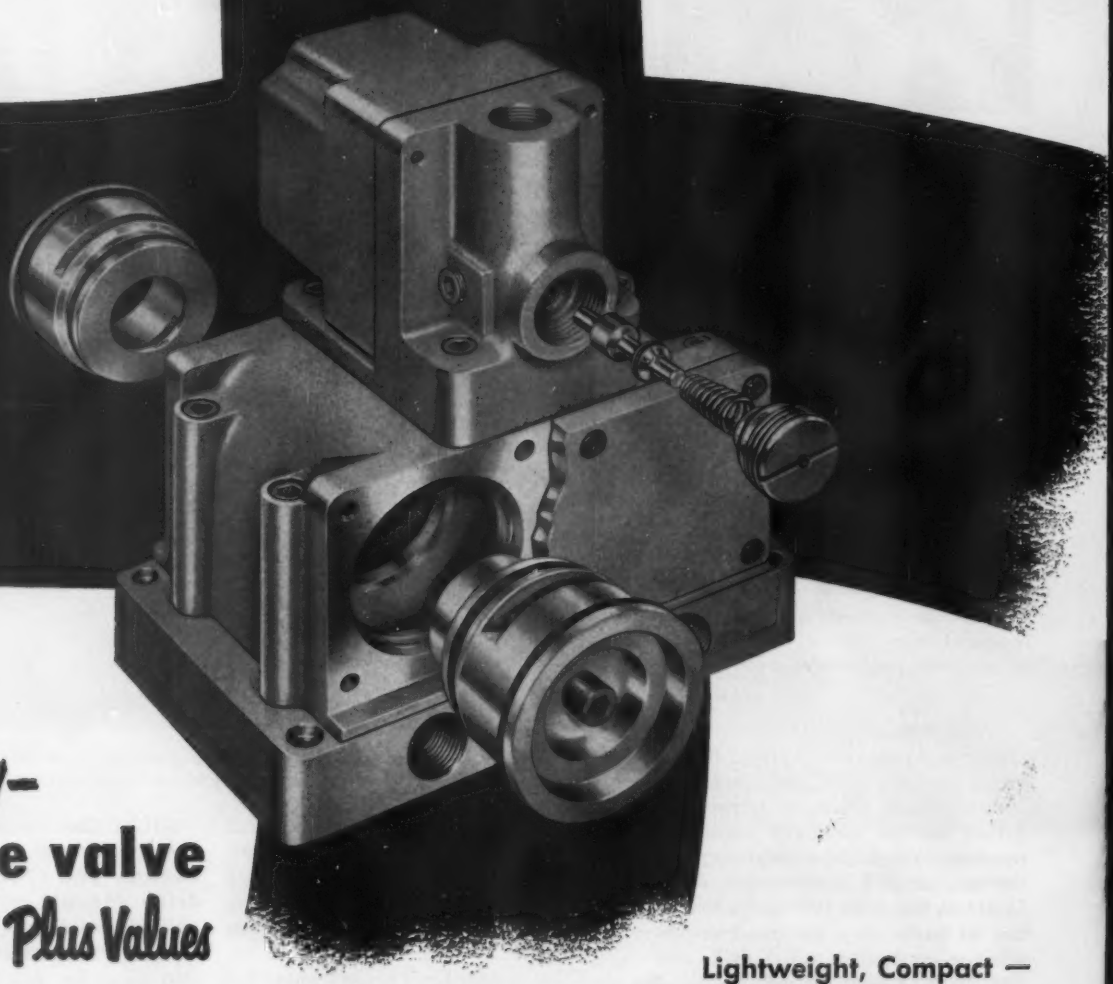
The preselector is perfect where the radial drill operator can plan ahead and set the speed and feed for the next operation while the machine is still under cut.

The manually controlled radial drill is called for where a variety of relatively simple parts are to be drilled in small lots.

All of the speed-feed controls just mentioned are available for Carlton 3A, 4A, and 5A radial drills. Manual controls only furnished on 0A and 1A models. For further information on how you can save by selecting the right speed-feed control for your metal drilling requirements, send today for descriptive bulletin. And remember, only Carlton offers you a choice of all three: programming, preselector or manual. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton *specialists in radial drills*

Now - Plus Values for you ..



Now- in one valve — all these Plus Values

"Flow-Director" Pilot Head—simplifies piping and makes desired operation possible simply by piping to the proper port.

Interchangeable Pilot Heads — any pilot head fits any valve, regardless of type or size.

Replaceable Seats, Self-Cleaning—fast and inexpensive replacement of all seats. Poppets do not seat in valve body.

Solenoids — are low amperage, continuously rated industrial type.

High Speed Operation — short stroke solenoid and poppet give split second response.

Full Flow—all passages oversized for minimum pressure drop through valve.

No Springs—piston-poppets shift with air pressure.

Lightweight, Compact — aluminum used extensively ... smaller over-all dimensions.

Corrosion Resistant — all materials corrosion resistant.

100% J.I.C. Conformance

- subplate mounted
- splash- and dust-proof solenoid covers
- solenoids inoperative with covers removed
- manual push buttons
- covers chained to valve
- *Dryseal* pipe threads

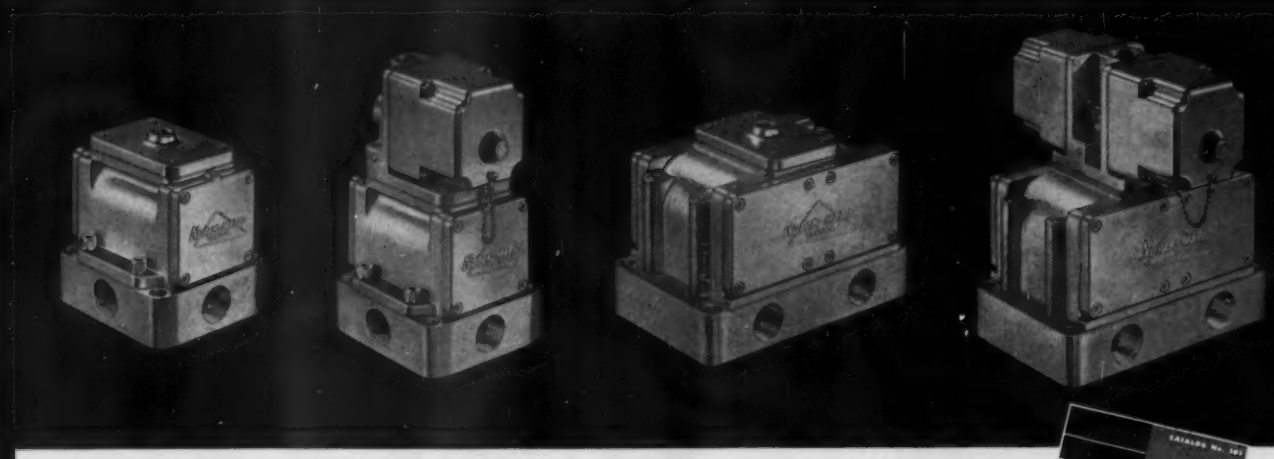
in the new *NOPAK-MATIC* poppet-type air control valves

100% J.I.C. — a complete line of poppet-type, snap-action, air control valves that comply in every detail to J. I. C. Standards . . . and *at no extra cost!*

Simplified Piping — exclusive "Flow-Director" pilot heads allow piping with fewer fittings . . . makes fewer valves adaptable to more applications.

Off 'n On In Less Than 2 Minutes — millions of trouble-free operations are assured but should maintenance be necessary, a complete valve assembly can be replaced in less than 2 minutes . . . piping is never disturbed.

3 Pilot Heads Fit All Models — all pilot heads (master, single or double solenoid) are interchangeable on all valves, regardless of type or size.



NOPAK-MATIC Valves are available in ¼" through ¾" pipe sizes for 2- or 3-Way Normally Open or Normally Closed and 4-Way operation. All valves can be operated with master (air), single solenoid or double solenoid pilot heads. Solenoids are available for all standard A.C. and D.C. voltages. Four-Way valves are available with side or bottom porting.

CATALOG NO. 105 — describes and illustrates all the Nopak-matic Plus Values and gives complete dimension, installation and parts data. Write for catalog 105 now. It will be mailed promptly.

NOPAK *VALVES and CYLINDERS*

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Special Size Reamers
ARE STANDARD WITH L&I

TWO MORE L&I EXCLUSIVES ...AT NO EXTRA COST!

DOWEL PIN REAMERS
Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.
14 Sizes from .1230 thru .4995" Sets, tool

OVER & UNDER SIZE CHUCKING REAMERS
Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.
14 Sizes from .124 thru .501" Sets, tool

These reamers are two more reasons why L&I is the source for a **complete** reamer line.
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Letters...

To American Machinist
330 W 42nd St, N Y 36, N Y

Rebuttal on Russian Series

In your series of Reports on Russia, your editorial team describes the tremendous advances of the Russian industry in very glowing terms. It would take too long to go into all the details, but I wonder whether your editors have really seen all the things they tell about, or whether they have been sold a bill of goods. The tenor of these articles would lead us to believe that the Soviet Union has made advances in the industrial development of machine tools and automation which threatened to out-produce American industry by 1960.

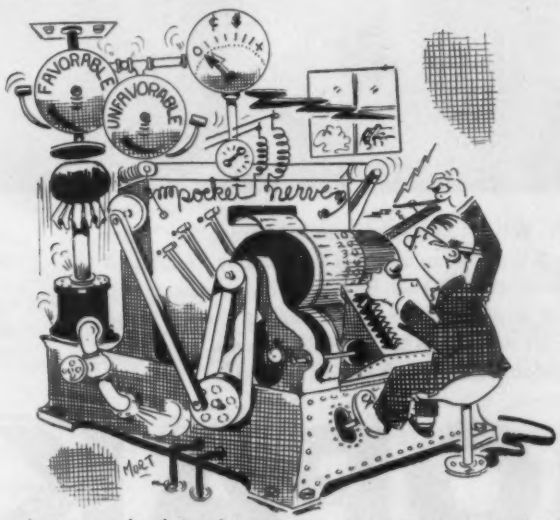
As one who has been active in the metal working industry for over 30 years, I believe I have learned to recognize production potentials and production capacities in machine tools. In the Fall of 1956 it was my good fortune to spend six weeks with a U S Trade Mission in Yugoslavia. Part of that six weeks was spent at the Zagreb International Trade Fair in which most of the Eastern bloc countries, including the USSR, had pavilions for the single purpose of exhibiting their latest products, appliances, machine tools.

I visited the Russian pavilion on three different occasions and took particular interest in the machine-tool exhibit. All the machines shown there, with the exception of prototypes, which were not for sale because, I was told, they were not yet in production, were mediocre machine tools at best. Why does the Soviet Union exhibit such mediocre equipment in this important international fair, when they have so much more to show, and when they are so advanced over their Western competitors?

It is also pointed out in these articles that the Soviet Union is still very much dependent on some of our Western machine tools and that most of the machine tools which were seen by your editors were copies of Western equipment.

It has been my observation that we have a tremendous capacity for either overestimating or underestimating situations and conditions. I certainly would not like to do either in this case, but I think it is important that we put the production potential of the Russian industry in proper focus.

Machines of Tomorrow



Impact recorder designed to test consumer reaction to contemplated price rises. (Designed by Digit Corp.)

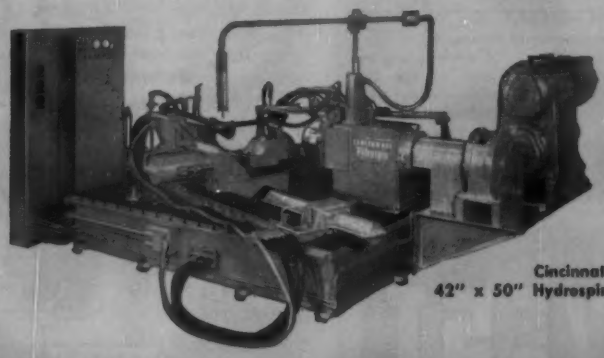
Official Marine Corps Photograph

This MAN Forms MEN

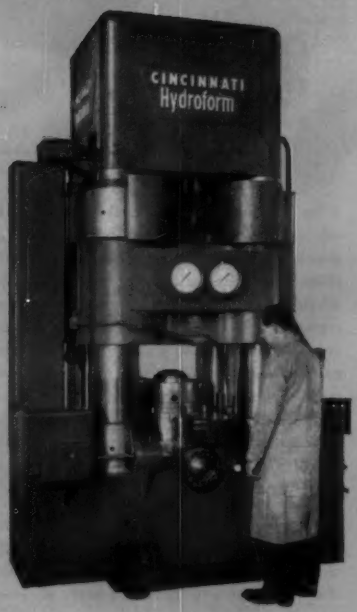
A Marine "D.I." (officially "Drill Instructor") guides each Marine through "boot camp" . . . shaping, strengthening, hardening, tempering the mettle that will enrich the greatest fighting tradition and *esprit de corps* in history.

These machines form metal . . . The Cincinnati Milling Machine Company's Hydroform® and Hydrospin®. In production on previously difficult-to-form aircraft, engine, missile and other components, they have greatly reduced vital development time . . . created savings of 50% and more in material, tooling and labor costs.

A Process Machinery Division field engineer will give you detailed information on applying Hydroforming and Hydrospinning to your metal forming jobs. Why not ask him to call?



Cincinnati 42" x 50" Hydrospin



Cincinnati® 19" Hydroform. Also built in 8", 12", 23", 26" and 32" sizes.

CINCINNATI

Hydroform · Hydrospin

PROCESS MACHINERY DIVISION

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

LEADERS IN INDUSTRY MARK WITH NOBLEWEST

ROLL-O-MARK

MULTI-PURPOSE ALL-PNEUMATIC MARKING MACHINE

1 *Roll-Marking into Surface of Piston*
2 *Serial Numbering into Metal Shaft*
3 *Permanent Marking and Graduating into Metal Collar*

Model 50P1

This multi-purpose Roll-O-Mark can be set up faster . . . tooled up easier . . . accommodates attachments more readily than any other marking machine. With all-pneumatic operation, no motor or separate power unit is required. Simply connect to the shop's air line—air is used *only* when in operation. This multi-purpose metal marking machine offers many other advantages such as—5" die slide stroke . . . open throat design . . . hand wheel for rapid table elevation . . . independent control for set up.

Whatever your needs for metal marking, Noblewest makes the machines, making dies, and work-holding fixtures for doing the complete job faster, better, at lower cost. And remember, Noblewest Roll Marking is *permanently* indented marking—*good for the life of your product.* There is a Noblewest Representative near you. Write for new catalog. The Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

A mark is only as good as the die that made it. Noblewest steel marking dies are precision made for permanently indented marking.

MARK IT BEST WITH

NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

To cite percentages of increased production as is done in these articles is practically meaningless, because we do not know the basis of comparison.

We do know, however, that the great majority, the masses in Russia, are still unable to buy any of the everyday necessities as we know them, such as household appliances, radios, television sets, up-to-date kitchens, and bathrooms. If the industrial production is so great, why is it that the people can't buy the things they need? I just don't believe that a development or production engineer who is living in poverty has the capacity to conceive improvements in products or equipment as readily or competently as our American engineer who is living with these modern things every day in his life.

It is, of course true that Russia is turning out a great number of engineers and has a terrific potential of labor, but I think it is equally true that neither their engineers nor their workers have the capacity to produce competitively with our American engineers and workers.

In my opinion, it is absolutely necessary to take a realistic approach to the Russian industrial potential. It would be a sad mistake if we underestimate the capacity of Russian industry, but I do not believe that there is any danger that Soviet production will outstrip American production by 1960 or even 1965. I would like to suggest that your editorial team be sent on an American tour

Helpful Henry

"Here, let me clean that off for you . . . OOPS!"

to take a close look at American industry and its potential.

J. Kleinoder
Queens Village, N Y

In the Reports on Russia, our aim has been, not to draw comparisons between American and Russian industry, but to report what we have learned about Soviet Metalworking: its background, its present position, and its hopes for the future. The claim that Soviet production and technology will surpass that of the United States by 1960 was made by the Russians, not American Machinist. *We merely reported it.*

Percentages of gain in production are admittedly less informative than actual output figures, but we have seldom been able to find out the concrete figures. Whenever they have been available, we have used them, as in the Fifth Report (AM—*Feb 11 '57, p146), which discusses lathes and radial drill presses.*

Reader Kleinoder raises a good question when he asks why the USSR does not display its best merchandise at an important international trade fair such as Zagreb. We don't know why. Once again, we are only reporting what our editors have actually seen, and in many cases photographed, in Russia itself—Ed.

Orphan Machines

In our machine shop we have three old lathes that were brought in here in 1921. They are: a Cisco, belt drive, 16 x 48 in., No. 481; a Rahn-Larmon, geared head, 18 x 72 in., No. B-36-1; and a Rahn-Larmon, geared head, gap lathe, 20 x 84 in., No. AG-27-3.

As you can well imagine, these machines are worn out. One time, our company made an unsuccessful attempt to find out where they were made in order to get replacement parts. Then last summer, they had one of them rebuilt, but we still can't cut a thread with it.

Now, can you tell me:
Who made these machines?
What year were they made?
Who originally bought them?
What was their price, new?

Stuart Holden
Winter Haven, Fla

We give up; our search has failed to produce results. Can our readers provide any information or clues?—Ed.

REED RID ©

Thread Rolling Attachments

Provide Full Diameter Range To Maximum Capacity

A multi-purpose tool of wide range for rolling machine screw threads, straight and taper pipe threads (including dryseal), annular rings, oil grooves, knurling and other cold forming operations. Eliminates secondary operations by rolling behind shoulders.

- For over 100 different single and multiple screw machines
- Adapters for more than 300 cross-slide applications
- Easy to set up and operate
- Simple precision matching with pre-matched rolls
- Dovetail clamping arrangement simplifies setup by permitting head to be removed from adapter
- Self-compensating roll action

Series B
Geared Type

FOUR STANDARD SIZES

Model No.	Complete Diameter Range	*Pipe Threads That May Be Rolled	Approximate Number of Common Screw Threads That May Be Rolled
B 10	0-⅝"	7	80
B 13	⅛"-13/16"	9	90
B 18	¼"-1⅛"	15	105
B 36	⅜"-2¼"	18	185

*Straight and Taper Pipe Threads, including Dryseal (NPTF). Change may be made from Straight to Taper Threading by changing rolls only. No other equipment is necessary.

ATTACHMENTS DESIGNED FOR SPECIAL APPLICATIONS

Attachments and Rolls for Straight Thread and Taper Pipe Thread In Stock—FOR IMMEDIATE DELIVERY

REED SERVICE PERSONNEL AVAILABLE to assist with initial installation. Application and Operating Instruction Book supplied with each attachment. Complete satisfaction assured.

Write for Attachment Bulletin B-1

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

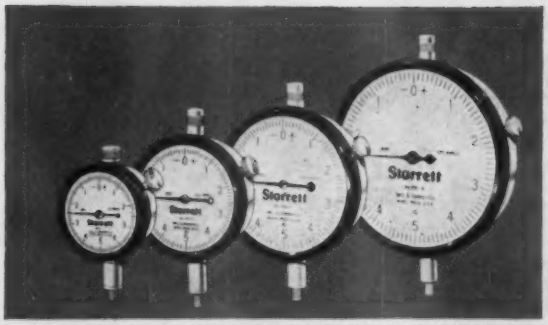
PRECISION COMES EASIER WHEN TOOLS BEAR THIS NAME... Starrett®

Ever notice how your best men insist upon Starrett Tools at the crib . . . and won't take anything but Starretts when they buy tools for their own kits? The reason is obvious . . . Starrett Tools sharpen their skill — make it easier to be accurate.

If what you want is more and better precision work, get the habit of specifying *Starrett*. It's such an easy way to please everyone and, at the same time, give the company an extra measure of quality and value.

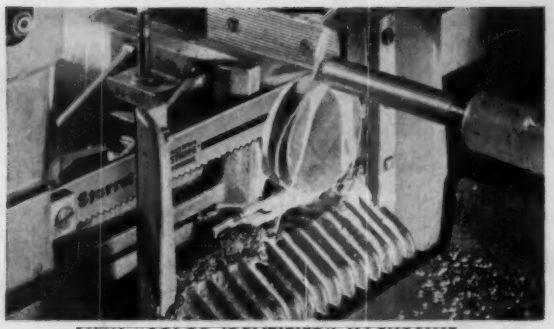
You'll find the Starrett name on a complete line of precision-made products — precision measuring tools, dial indicators and gages, steel tapes and rules, hacksaws, hole saws, band saws, band knives and precision ground die and flat stock. And Starrett Tools are always available through a convenient and reliable source of supply . . . your local Industrial Supply Distributor.

WHEN YOU MEAN PRECISION YOU SAY STARRETT



NEW HIGH-PRECISION, LOW-FRICTION INDICATORS

Featuring simple interchangeable construction with interchangeable gear assemblies; easy reading, eggshell finish dials; no-glare Satin Chrome Finish on case; black bezel. The complete line with 140 models to meet all requirements includes regular or nonshock types, balanced or continuous dials, jeweled or plain bearings, English or Metric graduations.



NEW "COLOR-IDENTIFIED" HACKSAWS

New Starrett Hacksaws are color-identified for quick selection and production-proved to give you the performance you need for any cutting job. Starrett also makes band saws, band knives and hole saws . . . uniform quality from one dependable source.

NO. 167 STAINLESS STEEL RADIUS GAGES

Made of stainless steel — rustproof and stainproof — satin no-glare finish. Each gage has five gaging surfaces for convex and concave radii. Available in six convenient sets. Handy gage holder also available.

NEW SAFE-FLEX® HOLE SAWS

Use these new double-welded, shatterproof hole saws for cutting large diameter holes in metal, plastic, wood. Interchangeable arbors hold a wide range of saw sizes. Shanks fit portable power tools, lathes, drill presses, etc.

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No. 657 with off-on push button for one-hand operation has universal adjustment including sensitive fine adjustment. Holds firmly to any iron or steel surface. Mounts any "Last Word," No. 196 or No. 25 Series dial indicator.

PRECISION GROUND DIE AND FLAT STOCK

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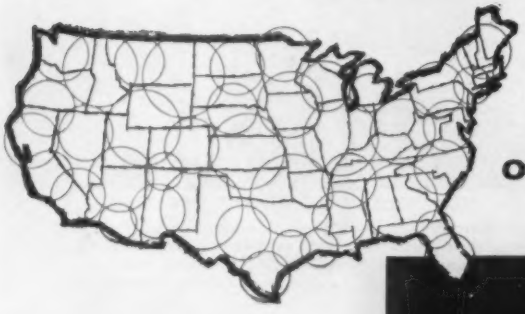

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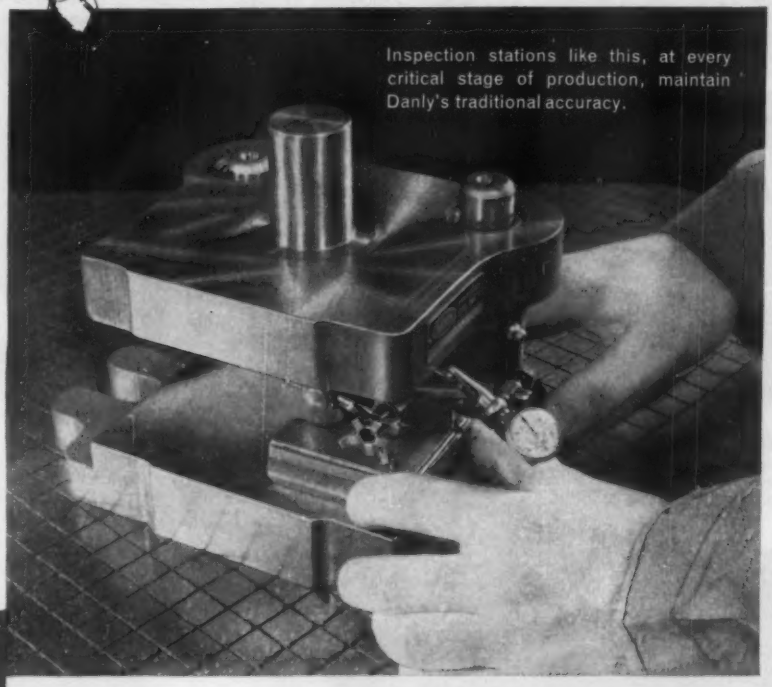
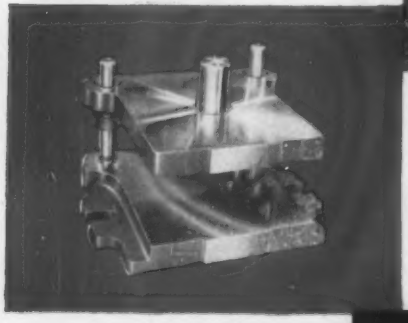
Danly leadership in die set distribution is made possible by the precision with which Danly sets are made. Precision makes Danly die set components completely interchangeable . . . parts can be stocked by branch assembly plants or distributors throughout the country and assembled for delivery in any of thousands of combinations as standard die sets to meet specific tooling needs. No matter where you are, from New England to California, you get the same Danly precision, the same broad selection, the same fast service.



Inspection stations like this, at every critical stage of production, maintain Danly's traditional accuracy.



Leading industrial distributors and Danly branch assembly plants—located in all major tooling centers—stock Danly Die Sets for fast delivery.

DANLY MACHINE SPECIALTIES, INC.

DANLY®

2100 South Laramie Avenue
Chicago 50, Illinois

Spot news...

- **New type of steel "sandwich" plate developed in Germany** consists of three thin steel sheets, with the middle sheet punched according to a certain pattern and point-welded at some places to the upper sheet and at other places to the lower sheet. Outside edges are then welded except at one point, where water is pumped in at high pressure—forcing the outside plates and distending the middle plate to form a rigid sandwich. For more on honeycomb, see p137.
- **Following Republic Steel's lead,** practically all major U S steelmakers today are stopping short of the finishing reductions and coming up with ¼-in.-and-under plate to (1) take up mill capacity unfilled by sheet orders, and (2) relieve an acute shortage in lightweight plate.
- **Salaries of established engineers may be adjusted to hiring rates** for new engineers if Boeing accepts proposals of a Seattle engineers' group. In essence: established engineers would get the same percentage increases as the year-to-year increased cost of hiring engineer graduates. And the plan may be retroactive for those years when company engineers' salary increases did not keep pace with climbing costs of hiring new talent.
- **Mercury's new "Super Mercury" will probably be called the "Olympian."**
- **First free-piston turbine-engine-powered farm tractor,** the "Typhoon," is being tested at Ford's Tractor & Implement Division.
- **Russians are using super-pressure water jets to shape tool steels and dies.** Water issues from jet at 30,000 psi at a 316.8 gallons per hr rate.
- **Unofficial world record of 16,454 sfm cutting speed on steel** has been established using ceramic tooling on a special Warner & Swasey turret lathe in a project conducted for that company at Ohio State University. A 13-in.-dia, 3½-in.-long blank of 1040 steel was cut at 0.011-in. rev to a depth of 0.040 in. Only one cut per tool edge could be made, however.
- **Look for heavy tooling expenditures later on this year at Ford,** which is still considered to be on a two-year model cycle.
- **Joint government-industry project to increase accuracy of tolerances** (goal: accurate measurement to 0.0000001 in.) is being undertaken by the National Bureau of Standards and Pratt & Whitney Co.
- **British government has canceled support of the most powerful turbojet**—the 25,000-lb-static-thrust DeHavilland "Gyron." It's too expensive for Britain's economy-minded government, so DeHavilland will carry on development alone. But the United States and France are very interested.
- **Is the government channeling too many engineers into "Buck Rogers" projects?** Donald Douglas of Douglas Aircraft thinks so: "In our striving to find the ultimate weapon of tomorrow, we should not neglect today's weapons."
- **Tool wear studies on production equipment,** using half-life, 24-hr Tungsten-187 (radioactive isotope) is reducing contamination and disposal problems in experiments at the GM Tech Center. One microgram of tool material (worn off in 1 sec) can easily be measured in the chips.

Spot index to major News stories...

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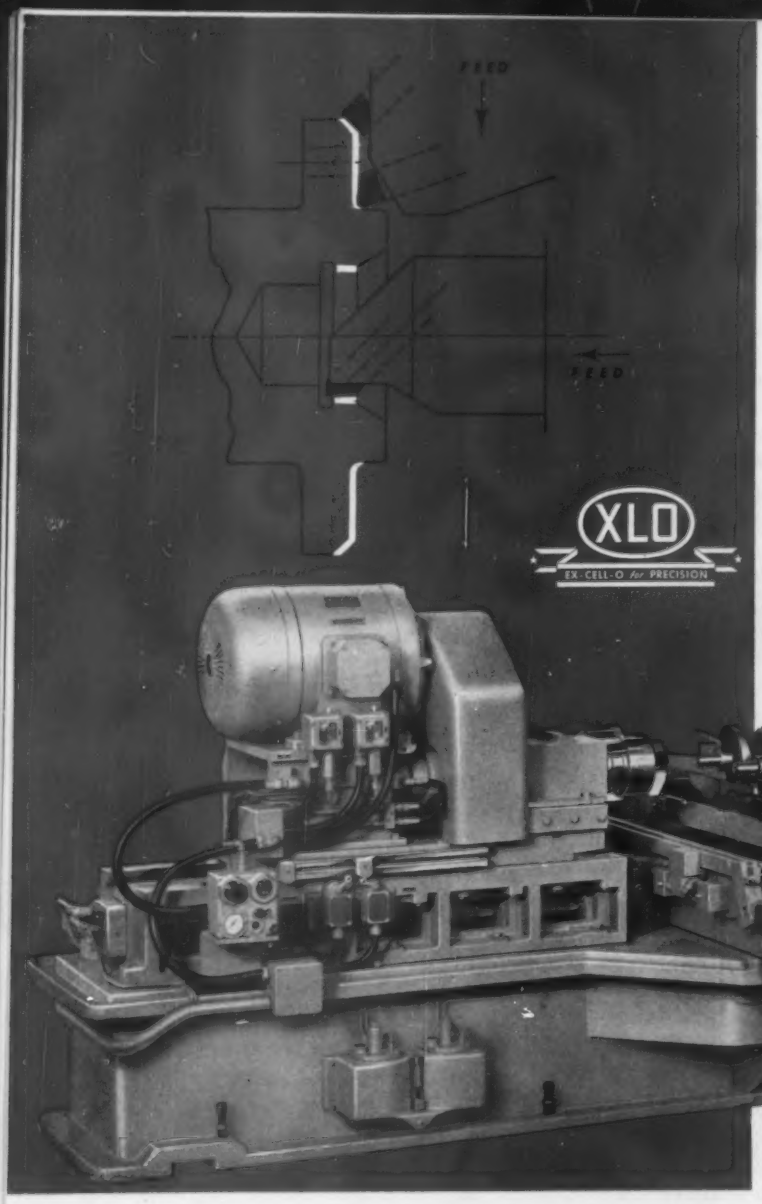

On this Ex-Cell-O special Machine two standard, hydraulically operated slides are mounted on a base with a transfer type fixture between them. The left slide, which supports the spindles, advances, and hydraulically operated chucks grip and rotate the parts. Then the right slide carrying the tools advances. Crankshaft operations include precision boring a diameter within limits of ±.0005", holding the bore concentric with main bearings, facing a surface square with main bearings, and chamfering an edge. Surface cuts are indicated in white in diagram at left.

EX-CELL-O Special Machine Bores, Faces 2 Crankshafts SIMULTANEOUSLY

What an improvement!

Automation equipment picks up *two* automotive crankshafts, places them in machining position, bores, faces and chamfers the flange ends simultaneously, and transfers them to the unloading position *all in one automatic cycle.*

Building special purpose machines is an Ex-Cell-O forte. Manufacturers with problems in accuracy, production, and in combining numerous operations, look to Ex-Cell-O.

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CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

55-38

Washington ... NEWS REPORT

New mobilization plans . . .

Major changes in the government's industrial mobilization planning for war are shaping up. Idea is to bring plans in line with new military concepts which stress reliance on nuclear weapons and the probability of a short war.

Up to now, mobilization plans have been based on the assumption of a prolonged industrial buildup to reach peak production in three years. Now the theory has been generally accepted that there may be no chance for an extended mobilization, that peak arms output must be achieved in just six months or less. This means more dependence on hastily stepped-up output from hot production lines—plants already producing military goods, and less or no reliance on conversion to defense production by idle plants or those making civilian items.

So the Pentagon is knocking off at least 50% of full mobilization arms requirements. Insiders say, for instance, that initial mobilization plans called for production of 115,000 medium tanks in three years; the new plan is for output of only 35,000. Plans for peak aircraft production under full mobilization are being scaled down from $42.5 billion annually to about $12.6 billion, only slightly less than double current plane output.

Actually, these changes have been in the works for a long time. Last January, for example, the Air Force overhauled its own mobilization program, came up with a new "Industrial Production Readiness Policy" to (1) set the stage for squeezing out as many finished planes and missiles as possible in selected plants right after a general attack on the U S, and (2) cut down the time required to get increased output from individual plants.

Now ODM and the other military services are following suit with a similar general policy. ODM has just issued a directive to all defense procurement agencies revising government-wide policy on "maintenance of the mobilization base." Its provisions are vague, but the general theory jibes with the Air Force plans: that the mobilization program must stress preparedness for post-attack production of the most urgently needed arms in selected plants, that this could be accomplished by getting certain plants ready with spare tools and facilities in advance.

A top official says the new ODM directive is a tipoff of more important changes in Pentagon mobilization policy. The planners have come around to where they have to reconcile current grandiose mobilization plans—still assuming a WW II-type mobilization—with the facts of new military capability.

Squabble over productivity . . .

Productivity has become a controversial, emotion-charged, politically-potent concept in Washington. The squabble started when administration economists noted that productivity —as measured in output per man hour—apparently rose less in 1956 than it has on an average since WW II. The Council of Economic Advisors pointed out in the President's Economic Report to Congress:

"The smallness of the 1956 gain (in productivity) contributed to the rise in unit labor costs and, in turn, to the increase in prices."

Later, BLS Commissioner Clague made plain what every productivity expert in Washington acknowledges—that only the roughest sort of statistical tools are available for measuring productivity over the short run.

Labor leaders say that blaming lagging productivity rates for everything from rising retail prices to the squeeze on corporate profits puts the onus for economic troubles unjustly on to unions. They argue that productivity seems to have started a sharp upturn in fourth-quarter 1956, that the trend is continuing.

The trouble is over how to measure productivity. Using the narrowest of common measurements—output per man hour of production workers in manufacturing—the 1956 gain seems to be either 2.5% or 1%, compared to a 4.5% per year average from 1953 through 1955. The 2.5% gain for 1956 is indicated if the FRB Index of Production is used to measure output, a questionable method because the FRB Index itself includes an assumption about productivity. The 1% gain is indicated if a production estimate devised by BLS—based on shipments of finished goods—is used.

If all manufacturing workers are included—not just production workers—the productivity gain, of course, is lower. Estimates for last year range from 1.5% based on the FRB Index, to no gain at all based on BLS'. These compare with increases averaging 3.5% for 1953-55. Broadening the workforce to include all non-agricultural workers gives still a lower estimate for 1956: no gain in output per man hour at all, compared to 3% per year from 1953-55.

With this as a backdrop, the government has an inter-agency committee at work to recommend more reliable productivity estimates.

BAY STATE

PRECISION PERFORMANCE...

To the figure skater, precision performance means executing the most difficult jump spins, spirals, counters, rockers, brackets and loops with faultless grace and apparent ease.

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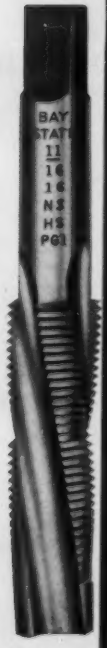

Detroit ... NEWS REPORT

What does 1957 look like?

With the critical winter season waning, what is in store productionwise for the auto industry for the remainder of the year? Will 1957 be good, bad or indifferent?

Traditionally, automakers look to the selling spree that's supposed to come in the spring of every year. That's when output schedules are buoyed by a mad rush for new cars.

But things could be different this year. Some hard-thinking Detroiters say that the old pattern of a big introduction spurt, a midwinter lag, a tremendous sales boom when the sap begins to run, and a before-new-model lag is no longer valid.

Times, they say, have changed. Our economic level is different today. For one thing, today's year-long constant advertising campaigns tend to level sales out through the year, with a possible sag just before new models come out. As a result, some auto men can't see a spring selling surge materializing from here on out.

Other disagree, of course. They say that the traditional spring spree, which was conspicuously absent last year, will return this year. By way of emphasis they point out that automakers will introduce "new" models (Ford's convertible hardtop, Cadillac's Brougham) to pep up sales, along with things like AMC's fuel injection, new paint job ideas, lots of gimmicks.

Second quarter looks this way ...

At General Motors: Chevrolet is lagging behind its 1956 pace, is unlikely to increase production to levels much above dealer orders—a move calculated to make its dealers happy. Then when the '58s appear, Chevvy will go all out with a car new from the ground up in an effort to establish sole rights to the No. 1 best seller spot.

Buick still isn't going full blast on production, but other GM nameplates are holding their own.

Overall GM production April through June will run somewhere in the vicinity of 800,000 units —tacit admission of a 46% market share.

Chrysler Corp is riding an unexpected boom of unfilled orders with a wild and joyous light in its corporate eye—so much so that Chrysler threw caution to the winds and admitted that if Walter Reuther hadn't agreed to upping production rates, it never would have made it.

That could go down in history as the year's worst foul-up in industrial relations. Chrysler's violently anti-Reuther locals may make the company sorry it ever brought the matter up.

Anticipating $1 billion-plus passenger car sales for the first quarter, Chrysler will cut back slightly on second-quarter production as deliveries begin to catch up with orders. April-through-June production will total about 335,000 units, contrasted with first quarter's 375,000. Chrysler's current 20.4% market share is expected to grow slightly in the next three months.

Studebaker-Packard will shortly announce its first profits in a long time, along with news of the jelling of an arrangement with Mercedes-Benz of Germany. S-P sales are reportedly rising and it looks like second quarter production will exceed the first quarter's.

American Motors' sales and production picture —indeed, its whole future as a factor in the automotive industry—has been clouded by the announcement that Miami financier Louis Wolfson is a very heavy investor in the company.

As we go to press, Wolfson has reportedly said that he will offer suggestions to AMC on how to make more money, and has indicated that he won't engage in a proxy fight.

Current Detroit word is that at least two nameplates will be dropped from the AMC line: that the Rambler (the only salable item of the three AMC nameplates) may or may not be retained.

Undoubtedly, Wolfson will move in with new ideas on management. He holds enough stock now (more than 250,000 shares) to exert a powerful influence. With his reputation for management, it is highly unlikely that he will countenance retention of any AMC segment that is a financial drain—and the AMC nameplates are definitely that.

You can also keep an eye to windward for a possible merger of AMC (its losses make an attractive target—taxwise) with another, non-auto, firm.

Production schedules, of necessity closely geared to sales at AMC, will undoubtedly drop.

The production outlook adds up to this: the industry is still geared to, and aiming for, a 6.5-million-unit year. Production schedules for the second quarter are paced at 1,730,000 units. Significantly, second-quarter cuts are a way of life in the auto industry, but production cuts for second quarter 1957 are only 4.6% below the first quarter, and a solid 19.3% higher than second quarter 1956. That means auto people think 1957 will be an excellent year.

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Power Gizzard Skinner Means Better Production for packers! Driven by a Master ¼ H.P. Double Parallel Gearmotor, output speed 230 R.P.M.

ANOTHER DRIVE REQUIREMENT MEETS ITS MASTER

"But my drive problems are different," you say, and right you undoubtedly are. Far as we know, this Master-powered Gizzard Skinner is unique.

But here's the point. America's productive genius consists of the ability to analyze a problem, devise a system and apply power to it in such a way as to produce better results faster at less cost. And *that problem* we bet you've got!

Let us help! Tell us the problem. From the drives listed here—or a combination of the required ones in one compact efficient unit—we'll deliver the goods! That's just what we've done for many, many years, to an ever-enlarging cross-section of American industry jealous of the performance of their motor equipment.

Motor Ratings..⅛ to 400 H.P. All phases, voltages and frequencies.

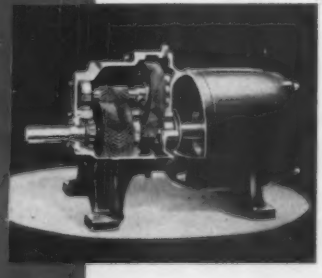
Motor Types.....Squirrel cage, slip ring, synchronous, repulsion-start induction, capacitor, direct current.

Construction.....Open, enclosed, splash-proof, fan-cooled, explosion-proof, special purpose.

Speeds.....Single-speed, multi-speed, and variable speed.

Installation.....Horizontal and vertical, with or without flanges and other features.

Power Drive Features.....Electric brakes (2 types)—5 types of gear reduction up to 432 to 1 ratio. Mechanical and electronic variable speed units—fluid drives—every type of mounting.



THE MASTER ELECTRIC COMPANY

Dayton 1, Ohio

Machine tools ... NEWS REPORT

Metalworking frontier . . .

If there is any one industrial area in the United States in which tradition is being dislodged and pioneering is being done in metal fabrication, it is southern California.

The pioneering springs from necessity. The airframe makers have rapidly been getting into the machining, forming and fastening together of metal alloys in which they have no experience to go on. It mostly becomes a trial-and-error process—and a very expensive one.

But today, almost more than at any previous time, they are caught in a real squeeze because defense authorities cannot make up their minds exactly what to order and in what quantities.

One thing can be said for sure: Air Force is in favor of jumping the speed of military planes or missiles up a lot all of a sudden. This poses a materials design problem and a serious production problem.

Certain plane makers remark that such specifications would mean redesigning every item that goes into the plane because of the all-important heat resistance factor.

More than that, just what will the materials be like? All stainless? And if so, how is the material to be machined?

New methods must be found of achieving a new kind of precision "in parts shaped from difficult-to-handle materials like titanium, high-temperature steels, ceramics, and combinations of ceramics and metals," General McNarney, president of Convair, declares.

"Today we have no machine tools or processes," he remarks, "with which to work many such materials adequately."

Despite all the uncertainties, the aircraft industry promises to be a very good source of machine tool business this year.

Distributors are optimistic . . .

Distributors who attended the meeting of the American Machine Tool Distributors' Association at Palm Springs are optimistic about the volume of new orders in the months ahead. Up to now, they report incoming business this year as brisk.

Metalforming machine outlook . . .

Builders of metalforming machines did a whopping business of some $300 million in 1956. Shipments went to almost all classes of consumers, but the automobile people were the biggest buyers, just as in metalcutting machines.

Production got increasingly better as the year went on, though the main rise was in the second quarter over the first. The final three months was the best quarter of all, but only by a small margin over the third quarter.

Press builders had so much business, especially from Detroit, that in a few cases they subcontracted entire machines to outside companies. An eastern manufacturer, for one, produced a sizable battery of presses for a midwest press builder.

Orders for presses in the first quarter of 1957 have fallen short of the same period a year ago. Most of the slack is traced to a reluctance of automotive customers to place orders at this time. Considerable optimism is being voiced, however, by certain builders who are now putting on the market newly-designed presses.

One press maker declares that his new orders hit a low mark last September and have been climbing ever since. He feels that orders will continue at a good rate all year. He reports export sales up materially, especially from Peru and Venezuela. He now is building presses to make steel kitchen cabinets in Venezuela.

Automotive buying of presses has not stopped altogether—one builder reports an order for more than $1 million of presses.

Press production, which attained such a high total last year, is still doing all right. One builder says his shop is loaded tight through August, working three shifts seven days a week. He is subcontracting twice as much volume as is going through his own plant.

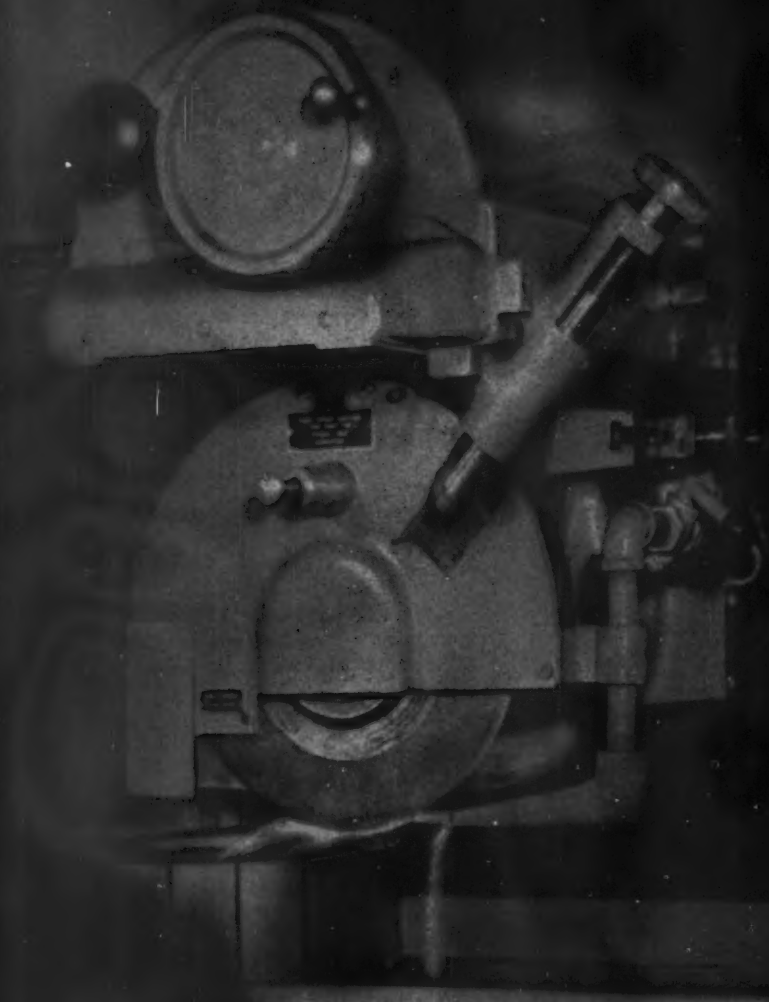
Another press builder is operating two 50-hr shifts, with output up 15% from the year-ago level. Backlog will carry current production rate up to middle of August.

A third press builder is running at a rate 50% above the same period in 1956. Backlog varies from five to seven months, depending on the type and size of press.

A fourth press builder states that he has enough business at hand to run the next five months. But he questions his ability to maintain his current rate longer than that unless orders increase.

WORLD'S MOST COMPLETE LINE

# of hydraulic surface grinders



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name the surface grinding job. . . Thompson has the machine

Thompson Type B

Surface dies or parts faster to part print, at lower cost, within wide size range

work size
6" x 18"
to
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Thompson Type F

For greatest precision, sensitivity and versatility in toolroom. . . or parts production at low cost

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and
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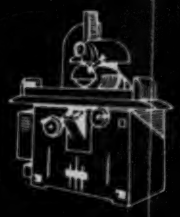
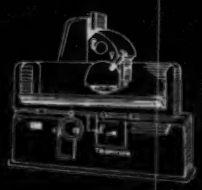


Thompson Type C

Meets production and cost demands in larger size surface work of all types

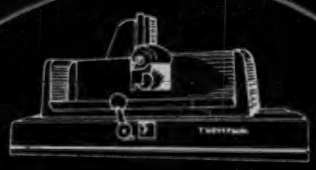
work size
12" x 40"
to
24" x 168"



Thompson Type CX

Offers both power and precision for heavy duty production. . . fast, accurate

work size
30" x 72"
to
36" x 240"



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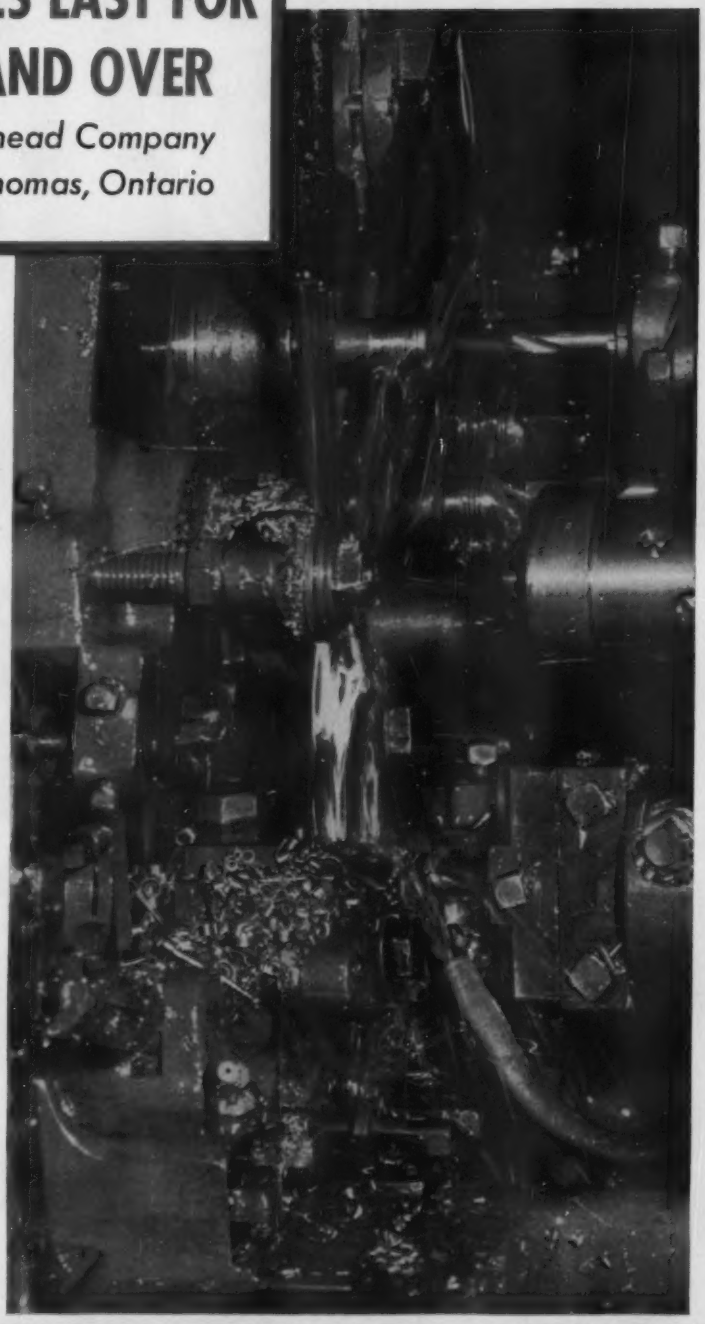
. . . reports Weatherhead Company of Canada, St. Thomas, Ontario



The job is making ⅛" pipe plugs of B 1113 steel. Work is done on Davenport automatics, and the threads are rolled on.

Using a competitive brand of cutting oil, Weatherhead had been getting only about 15,000 pieces between roll changes and found excessive wear on form tools and drills. Seeking improvement, Weatherhead tested other brands of cutting oil including *Texaco Cleartex Oil B*.

Results with *Texaco Cleartex Oil B* were so vastly superior that it was quickly adopted for production runs. That was five years ago. Since then, Weatherhead has been getting a roll life of 100,000 pieces, and greatly increased life for all tools.

Texaco Cleartex Oil B is only one of the complete line of Texaco Cutting, Grinding and Soluble Oils designed to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the proper ones.

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NEWS REPORT

What's ahead ... in Metalworking

Let's look at the record ...

In this era of scare talk and loose speculation over the immediate future of business, it might be well to take a look at the record. It's right here at the bottom of this page, American Machinist's Index of Metalworking Production.

It shows that overall Metalworking output in February has declined just three points since December. And where was the December figure? At the highest level in peacetime history. February, a "declining" month on the books, was nine Index points above year-ago levels, nearly 30 points above two-year-ago levels, and 40 points above 1954's post-Korea low.

That by any standards means that 1957 is starting out as one of metalworking's great, not just good, years.

Nevertheless, there is no overlooking the fact that demand has softened in some major segments of metalworking in recent months—notably automobiles and appliances—and that this in turn has had its effects on all industry.

Automotive sales as we go to press are running slightly behind those for 1956 and production schedules on some nameplates have been slowed. Accordingly, any setback in Detroit quickly makes itself felt among the suppliers of auto materials, parts and services.

The steelmakers, for instance, report that production is easing off on the more common items —sheet, strip, cold-rolled bars and forging stock. Ingot production is now running anywhere from 95 to 99% of January 1 levels. But those items not in automotive industry demand, such as plate and pipe, are still at a premium.

The stamping industry, which depends upon the automotive and appliance industries for much of its bread and butter, presents a mixed business picture, with some shops operating at capacity, others dragging their feet. But here again it is noteworthy to see that those shops which have gone out after non-automotive and non-appliance business to tide them through the slow period report an increase in sales, rather than a decrease. One such shop has actually increased its sales and production 30% over last year.

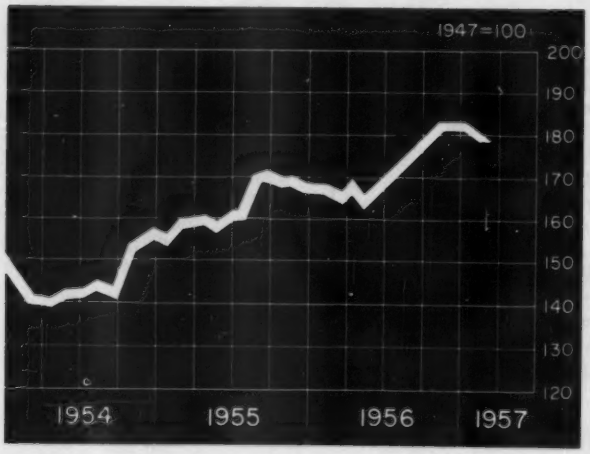
The stamping people are in accord with auto industry predictions that sales will pick up fast in the spring and that 1957 will wind up as a good (6.5-million units) year despite setbacks.

Screw machine products firms are feeling the pinch from lessened auto and appliance sales and from a cutback in housing starts. Backlogs generally are down 15% from December levels.

But what about the metalworking industries that aren't geared directly to autos and appliances?

- More orders were placed by industrial distributors for production tools, supplies and equipment in January than in any month in history.
- Resistance welder manufacturers report net January orders increased 73% over December.
- Gear manufacturers did 10% more business in January than in December.

In short, metalworking aside from its two great soft spots, is doing pretty well these days. The people in the middle of those two soft spots are very optimistic about a spring upturn.
And this is the first week of spring.



179

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	FEB. Estimated	JAN. Preliminary	DEC. Revised	JAN. Year Ago
Total Index	**179**	**180**	**182**	**170**
Machinery	**153**	**155**	**147**	
Electrical Machinery	**214**	**218**	**196**	
Autos	**144**	**149**	**152**	
Other Transportation ...	**356**	**347**	**298**	
Other Metalworking	**140**	**145**	**140**	

Chief of Engineers say:

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

NEWS REPORT What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	FEB. Estimated	JAN. Preliminary	DEC. Revised	JAN. Year Ago
Total Index	**151.4**	**151.1**	**150.5**	**141.5**
Metalworking Machinery	174.5	174.4	160.9	
Other Machinery exc. Electrical	159.7	159.0	148.1	
Electrical Machinery	152.0	151.4	137.8	
Fabricated Metal Products	143.1	143.3	136.0	

Is there *really* a squeeze on profits today?

Favorite pastime today of business's prophets of gloom is the search for "hot trails" leading to a recession or depression. But inevitably these hot trails have had a tendency to peter out into a haze of obscure reasoning based on little factual information.

A case in point is the widespread belief that a squeeze on profits, if it keeps up, can trigger U S business into a recession. There is undoubtedly some foundation for this belief. It is not at all unusual to read this in a company's annual report: "We chalked up record sales in 1956, but profits were down from 1955."

And it is true that the first three quarters of 1956 showed a progressive decline in profit margins. But the President's Council of Economic Advisors has come up with evidence that the profit squeeze began to reverse itself in the fourth quarter and is still doing so. The reasons: increased sales and substantial price increases.

There are other "hot trails" being followed eagerly by the gloom-and-doom boys, too. They point to the drop in housing starts, to the public's failure to beat down the doors of auto showrooms to get at the sleek 1957 models.

But there is a tendency on the part of the pessimists to overlook today's larger economic issues, which are all to the good:

- Consumer income is at an all-time high, and built-in wage increases will send it higher.
- Retail sales are running at a high level (except for automobiles) and moving up.
- Government spending (national, state, local) is at a peacetime high, is increasing constantly.
- Business investment is breaking all records, despite over-publicized minor cutbacks.

That's why, as McGraw-Hill's Economics Dept puts it: "We think the business outlook is OK."

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	148.6	149.7	149.6
Steel ingot operation (thousands of tons)	2,373	2,411	2,477
Electric power output (million Kilowatt hours)	11,867	11,791	11,133
Production of automobiles and trucks	171,409	172,816	165,403
Engineering construction awards (Eng. News-Record—millions)	$ 412.3	$ 320.4	$ 648.9

MONTHLY BUSINESS INDICATORS

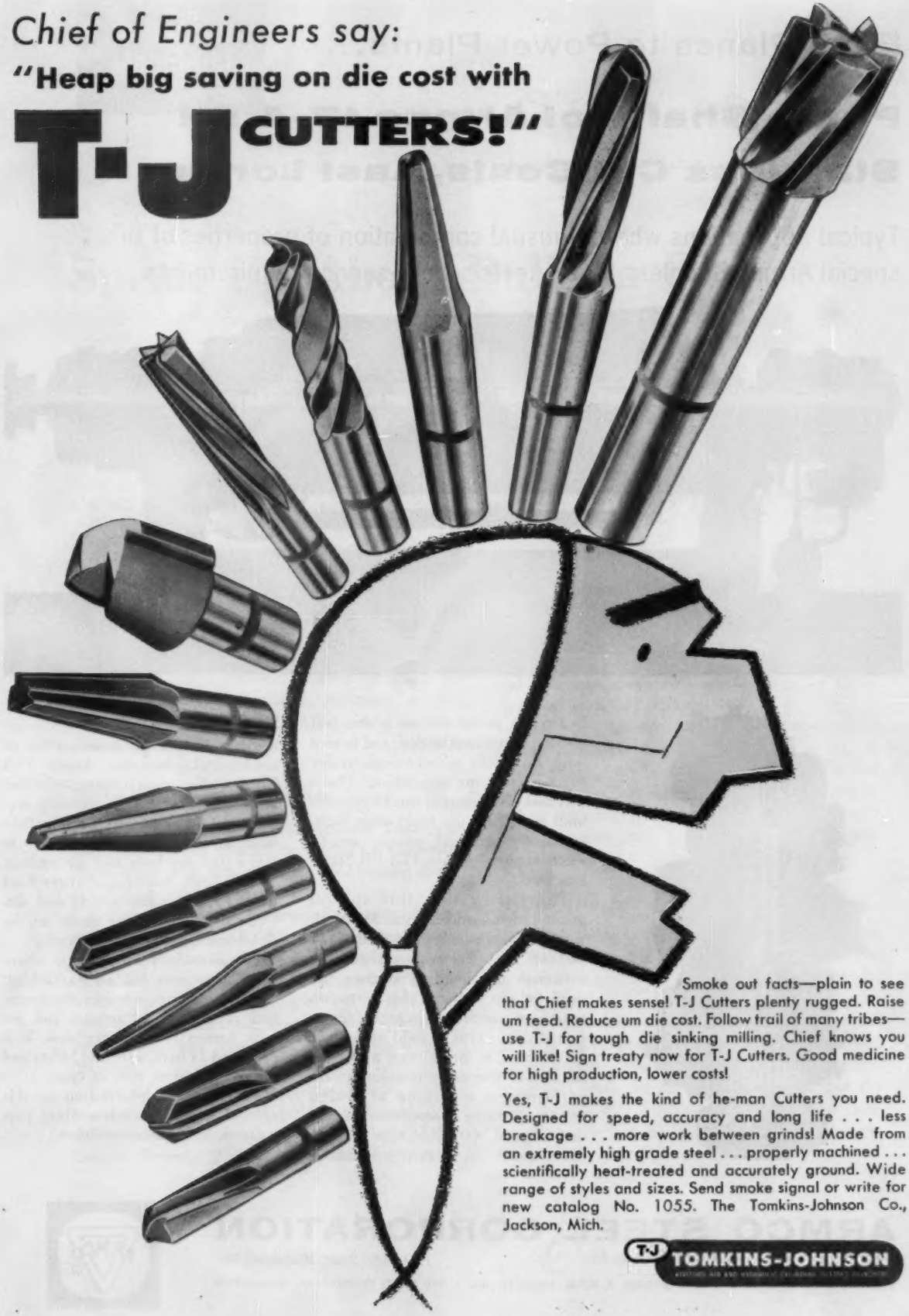
	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	146	147	143
Index of durable manufacturers' production (1947-1949=100)*	164	166	160
Durable goods manufacturers' sales, millions*	$14,607	$14,507	$13,595
Machinery manufacturers' sales, millions*	$ 4,237	$ 4,125	$ 3,691
Durable goods manufacturers' new orders, millions	$14,389	$14,544	$14,683
Machinery manufacturers' new orders, millions	$ 4,203	$ 4,054	$ 3,806

* Seasonally adjusted.

Chief of Engineers say:

"Heap big saving on die cost with

T-J CUTTERS!"



Smoke out facts—plain to see that Chief makes sense! T-J Cutters plenty rugged. Raise um feed. Reduce um die cost. Follow trail of many tribes—use T-J for tough die sinking milling. Chief knows you will like! Sign treaty now for T-J Cutters. Good medicine for high production, lower costs!

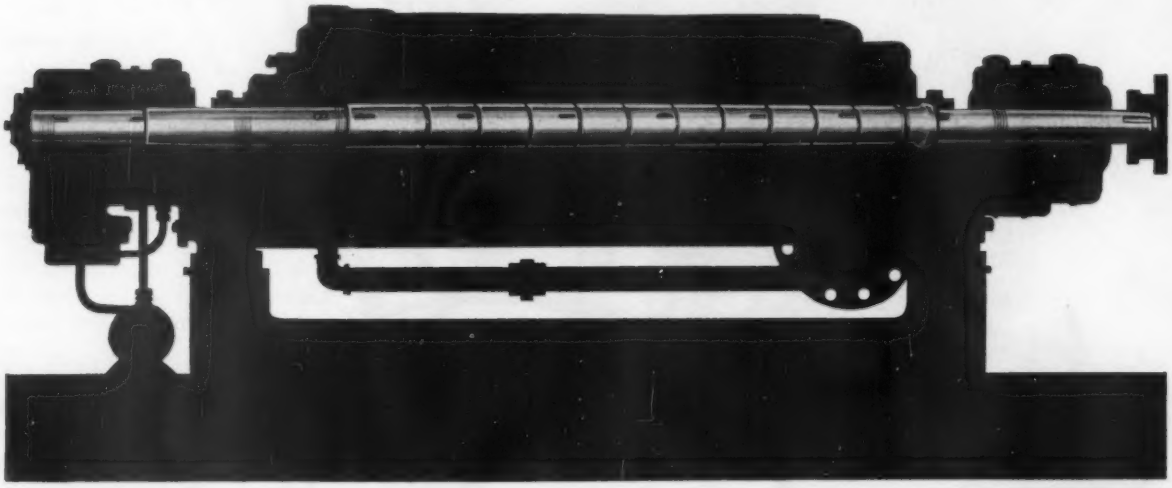
Yes, T-J makes the kind of he-man Cutters you need. Designed for speed, accuracy and long life . . . less breakage . . . more work between grinds! Made from an extremely high grade steel . . . properly machined . . . scientifically heat-treated and accurately ground. Wide range of styles and sizes. Send smoke signal or write for new catalog No. 1055. The Tomkins-Johnson Co., Jackson, Mich.

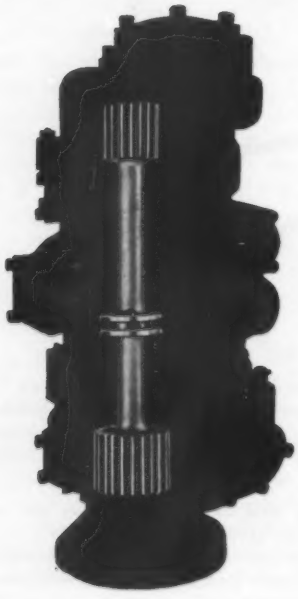
T-J TOMKINS-JOHNSON

From Planes to Power Plants...

Pump Shafts of Armco 17-4 PH Stainless Cut Costs, Last Longer

Typical applications where unusual combination of properties of this special Armco Stainless Steel meets severe service requirements





In aircraft, power stations or chemical plants, pumps must be designed to give long, unfailing service even under rugged operating conditions. That's why many designers of small hydraulic units as well as huge multi-stage, high-pressure centrifugal pumps, specify shafts made of Armco 17-4 PH Stainless Steel.

They know that this special precipitation-hardening stainless steel, with a typical tensile yield strength of 180,000 psi, effectively resists high torsional and bending stresses. Its good fatigue strength plus corrosion resistance guards against early failure. In addition, a typical yield strength of 110,000 psi at 900 F, and a low coefficient of thermal expansion, assure performance according to design where operating temperatures reach the range of 900 F.

Simplifies Production

Besides its unusual combination of mechanical properties, Armco 17-4 PH also offers outstanding production advantages. It can be readily machined in the annealed condition, then fully hardened by heating at 850 to 900 F for one hour and air cooling. This simple, low-temperature heat treatment eliminates scaling and distortion. In most cases parts can be *finish-machined before hardening.*

For parts in your products where conditions call for an extra-high strength material, consider the design and production advantages you get with Armco 17-4 PH Stainless. It is produced in bars, wire and billets and can be forged as well as cast.

For complete information on this special Armco Stainless Steel, just write us at the address below.

ARMCO STEEL CORPORATION

1067 Curtis Street, Middletown, Ohio

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

Speak Up About Bulletin F

Back in 1934, almost a quarter of a century ago, the Internal Revenue Service issued a now-famous document known as Bulletin F. It set forth a table of useful lives for all kinds of standard production equipment. These lives, in general, were put as 15 to 20 years or even longer, varying with the types of machines.

Bulletin F was never intended, so the story goes, to be more than a guide to revenue officials in determining depreciation writeoffs. But it soon was accepted as the Bible. And it has retained that reverential standing with the revenuers through the ensuing years.

Meanwhile national administrations have come and gone. Today's machine tools—in design, precision, production performance, automatic operation—bear slight resemblance to those of the depression era.

Many kinds of machines . . .

now in use were not even in being then. Today an increasing number of machines become obsolescent much faster than they formerly did, making their useful lives much shorter.

Bulletin F long ago became an unrealistic document as a result of these developments. More than that, the application of its tables became inequitable to manufacturers in writing off their production equipment. It also encouraged them to hold onto outmoded, high-cost machines long after their useful lives had expired. Thus progress was thwarted.

Even as recently as several months ago, a survey among capital goods producers showed that almost half of them felt that present methods of the Internal Revenue Service for determining service life of production equipment are not satisfactory.

After being pounded and hounded for years, the Internal Revenue Service, recognizing the validity of the criticisms of Bulletin F, has recently suspended its operation until a new and more realistic set of suggested rules could be formulated. For this action, Internal Revenue deserves a big vote of thanks.

An advisory group . . .

of five experienced men has been created by Internal Revenue to study and recommend a revision of Bulletin F to bring it into line with the times. The public is being invited to submit suggestions and comments that might contribute to an up-to-date, eminently fair Bulletin F.

Some manufacturers have argued that no good excuse exists for keeping Bulletin F at all. It should permanently be relegated to oblivion. Be that as it may, the fact remains that Internal Revenue has no intention of doing away with it. The only sensible course, then, is to work toward the best possible revision.

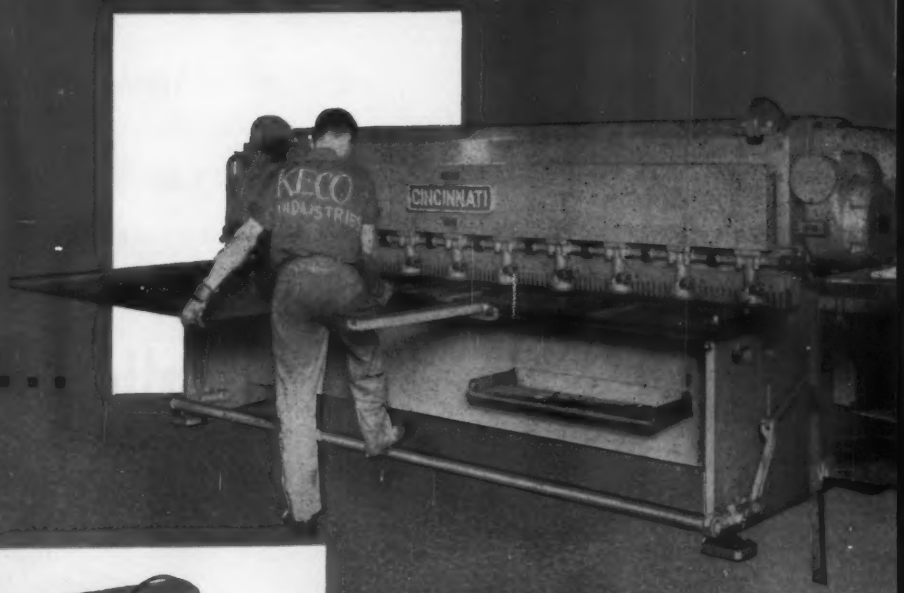
All of the foregoing . . .

is leading up to the suggestion that if you do not like Bulletin F and if you have any ideas about how it should be altered to meet today's requirements, now is the time to speak up.

The Internal Revenue Service will welcome constructive recommendations. Send along facts and figures and concrete examples as much as you can to support what you advocate. Remember that the new Bulletin F will have a profound effect upon how fast you will be able to write off your new machines.

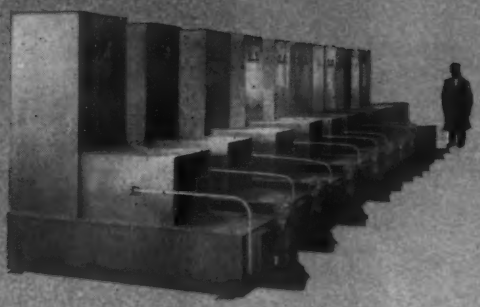
Burnham Finney EDITOR

3 times as fast...



with this CINCINNATI team

Photographs courtesy of the Keco Industries, Cincinnati 25, Ohio



Cooling towers for portable air conditioning units

The floor-to-floor time consumed in shearing and forming panels for air-conditioning units, was cut from 12 minutes to 4 minutes at Keco Industries, using a Cincinnati Brake and a Cincinnati Shear.

Accuracy and rapid handling effected these savings.

In your shop, there may be opportunity for real cost reductions. Investigate Cincinnati Shears and Cincinnati Press Brakes.

Write **Department A** for Cincinnati Shear Catalog S-7R and Cincinnati Press Brake Catalog B-4R.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

Reg. U.S. Pat. Off.

Straight-line production . . .
. . . of a single part through a small press dept offers no serious problems

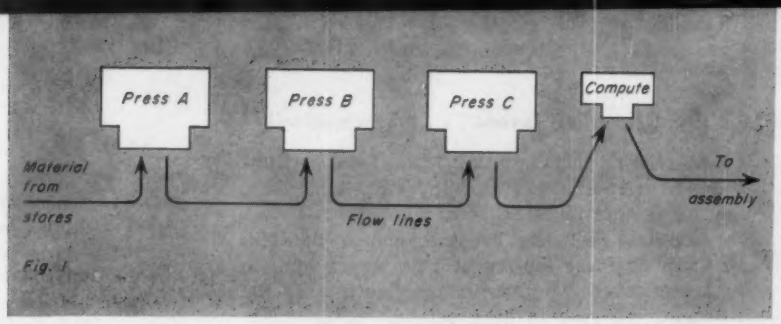


Fig. 1

Flow of two parts . . .
. . . through the same dept, but in different sequences, sets up distinct problems of machine arrangement

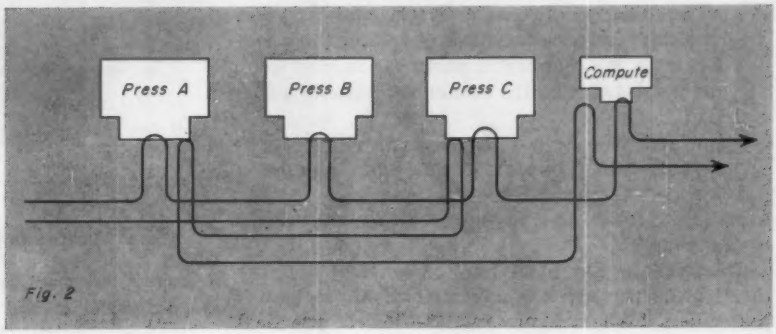


Fig. 2

American Machinist

Make the right plant layout . . mathematically

Here's an easy way to rearrange a department to insure that work in process travels the minimum distance, even if many different parts are produced on only a few machines

PETER C NOY,
CANADIAN GENERAL ELECTRIC CO LTD, BARRIE, ONT

Most manufacturing areas are arranged by size of the machine, rather than from the viewpoint that there is a correct place for each machine, depending upon the number of times it will be used in processing. Generally, the small presses will be grouped together, the drawing presses together, and so on. Sometimes, an attempt is made to fit the machines to the process, this being done more frequently as the number of different parts produced in the department becomes smaller.

However, when the number of different parts produced is large, the complexity of the problem appears overwhelming and machines are arranged to suit the larger and more troublesome parts, even though the total of the smaller parts, with perhaps less operations per part, may really be the greater problem.

In the automotive and other high-production industries it has been found possible to group presses more advantageously, because production is such that a particular press must operate full time on one job. If this job has more than one operation, it follows that there must be a line of presses as close together as possible. This is, of course, the maximum in efficiency. But how can this be done when there are perhaps 300 parts, some with as many as ten operations, and a scant 15 presses to do the job?

However, we know that if we move just one press we have made the work travel a farther or shorter distance. The trick lies in finding an easy way to tell what effect any move will have.

In a punch press department, the parts are usually carried between operations in lift-truck boxes, or in pallet loads. The method described below takes this into account, but can also be used where parts are moved singly.

Consider the following simple case. In Fig 1 we see a small punch press department and the flow lines of a part through it. This part flows in the best manner possible, and the total distance traveled is the minimum practical. The part has three operations and is finally weighed on computing scales and dispatched to assembly.

In Fig 2 we see the same area producing two other parts. These parts cannot go to press A first, press B second and so on. It happens, as usual, that press A, is largest and is needed for the larger dies, press C for the smaller. These physical limitations are the rule rather than the exception and so we are faced with the problem of arranging the presses to insure a minimum total travel of all parts through the department.

In this simple case we could apply all the combinations possible but suppose we were dealing with 300 parts with their various number of operations, and with 15 presses. The number of possible combinations would be too large to deal with.

Further, we must add a complicating factor, that

Make the right plant layout . . . mathematically

is, the number of parts in a unit load. Total production requirements are also important, and these weighting factors must be considered.

The method that has been developed becomes more valid as these figures become larger and, in no case, however complicated the figures, are the calculations too long to be practical.

Looking at Fig 1 and 2 again, we must find a way to mathematically express the flow of material. Let d be the total distance traveled by one part in process. Let y be the number of parts per unit of time, say one year. Let n be the number of parts in a single load.

Then y/n will be the number of single loads (henceforth called boxes) in one year, and dy/n will be the number of box-feet per year, or the number of feet a lift truck must carry loaded boxes in one year.

Then dy/n is the whole total of box-feet per year of all parts through the department. It is obvious that when this last figure is at its lowest practical value, we have the best layout.

The quantity d, feet traveled per year, is a function of the position of the press and the demand for this press in each possible position of any layout. If the demand can be found at each position in the layout, we can define the best layout.

As a practical example, suppose we have to produce the parts shown in Table I. At the left is the name of the parts, and opposite the part concerned are the operations that each must visit, in order.

TABLE I

		n	y
Cinch Arm	A C F G B D Com F C Com Deg	5	150
Lever End	C F B G Com F Com Deg	3	150
Pivot	A G B F Store Com F C A Com	1.4	350
Side Guard	G A C B Store D F D Com Deg	4	75
Retainer	A C B F Com F Store	3.2	160
Bottom Plate	B Com A Store D F C Deg Com	0.75	200
Baffle	F C A Com D Store F C	0.50	200

TABLE II .. DEMAND-POSITION VALUES

	1	2	3	4	5	6	7	8	9	Tot
A	525		360	200				350		1435
B	200	350	225		310					1085
C	150	225	200	160			700		400	1835
D				150	275	200	75			700
F	150	200	500			1085	150	360		2445
G	420	150		150						720
Compute		200			700		160	375	516	1951
Decrease								200	99	299
Store				625			200		50	875

TABLE III

Part	op 9	y	n	y/n
Cinch Arm	deg.	150	5	30
Lever End	deg.	150	3	50
Pivot	com.	350	1.4	250
Side Guard	deg.	75	4	19
Retainer	store	160	3.2	50
Bottom Plate	com.	200	0.75	266
Baffle	C	200	0.50	400

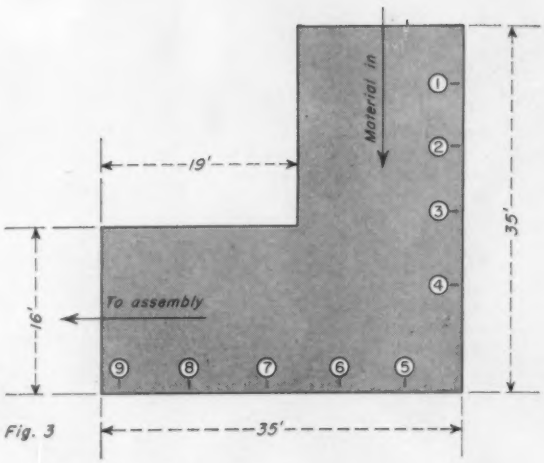


Fig. 3

Floor plan of dept . . .

. . . regardless of shape, must be marked off into numbered areas, the number approximating the arithmetic mean of the operations per part

That is, taking the Cinch Arm, the part first goes to press *A*, then to press *C*, then to press *F*, and so on. *"Com"* stands for compute, *"Store"* stands for a storage area, and *"Deg"* for degrease. At the right are the quantities n and y; respectively, the number of parts per box, and the number of parts required per year, in thousands.

The next thing we need is a scale drawing of the area available. In the example, Fig 3, it is an L-shaped area, to show that the system works regardless of the shape of the area.

The next step is to mark out the area into smaller areas, starting where the raw material enters, and working toward the exit. The number of divisions selected (in this case nine) should be close to the arithmetic mean of operations per part. In this example we have selected nine areas because we have 63 operations and seven parts, making the arithmetic mean of operations 63/7, or 9.

The next step is to make a table (Table II). The vertical columns represent the nine areas; the different machines are indicated in the horizontal columns in any order whatever.

After this refer to Table I and count the last operations of each successive part. These are: degrease, in the case of the cinch arm; degrease for the lever end; compute for the pivot; degrease the side guard; store the retainer; compute the bottom plate; and press *C*, for the baffle. Writing these down in order, we have the arrangement in Table III.

Then we calculate the quantity y/n, the number of boxes per year, and place this in its proper place in the charts, Table II, under the vertical column 9, because it is the last operation group, and we wish all work to end as close to the end of the area as possible.

The sum of the y/n quantities for degrease in the last operations is: $30 + 50 + 19 = 99$. Similarily, sums for the other operations in the last position are:

Compute $266 + 250 = 516$
Store $= 50$
C $= 400$

These are all placed in their proper places in

vertical column 9, in their respective horizontal columns. The rest of the nine positions are calculated and placed in their respective horizontal columns.

It is not necessary to put these down as shown in Table III. A simple calculation is all that is necessary, and the quantities y/n, once calculated, are ready to use as they crop up elsewhere.

A complication that may occur is when the number of operations on one part differs widely from the rest. Consider a part having 12 operations, and another having only three. Obviously, as we work from position 9 to position 1, there being only three operations on one part, we may be attempting to put it in a position in the layout that it may not best occupy. That is, we are considering the part to be best started toward the end of the department area. The main thing is to avoid backtracking, so we can make up a chart as shown in Table IV. It will be seen from this that the positions for part 2 have been spread, and those for part 1 have been compressed. This means that the layout will be best for part 2 to have its first operation near the start of the department, its second near the middle, and its last toward the end. If such an arrangement is used, then "Compute," the second operation of part 2, would be put in col 5 on a chart of the type shown in Table II.

When the number of operations is predominantly the same, it may not be necessary to do this. But look out for parts with substantially more or less operations than the average and which have a large y/n value.

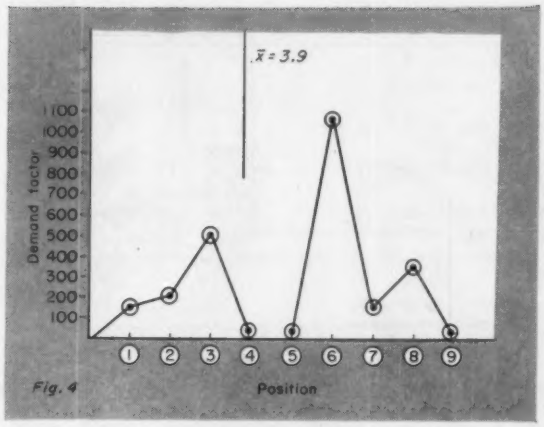
Note that in Table II, the figures in col 1 are larger than can be accounted for by the above method. This is because the cinch arm has 11 operations. Because the main concern is to keep the work moving through the department, the first three operations have been grouped in this case and called one. When the method has been tried in a couple of cases, the reasoning behind this will become clear.

The next step is to calculate from the table the proper position for each machine in the department. To fully understand this, we must understand that the figures in Table II are *demand* factors, proportional to the number of boxes per year at each operation. Thus, at operation *A*, position 4, the demand is 200; and at operation *A*, position 6, the demand is zero.

To understand this, take operation 9, for instance, and draw a graph of the demand factors in each floor position, as shown in Fig 4. This shows that there are two well defined areas in which this press is in demand. If it were possible, we should provide two presses of this type, group positions 1 to 4, and place one such press at the mean. We would also group positions 5 to 9, calculate the mean, and place another here. However, as we are more often than

TABLE IV

	1	2	3	4	5	6	7	8	9
Part 1	A	C	BD	F	HCom	C	DF	deg	Com
Part 2	A				Com				G.



Demand-factor graph . . .
. . . made for demand at each position indicates areas in which a particular machine is in maximum demand

not bounded by physical limitations, we will consider it necessary that we have only one press.

The arithmetic mean, then, of this position-demand is: (from Table II)

$$\frac{(150 \times 1) + (200 \times 2) + (500 \times 3) + (1085 \times 6) + (150 \times 7) + (360 \times 8)}{2445}$$

$$= \text{approximately } 3.9.$$

This press must therefore be placed as near as possible to 3.9 on our floor area, Fig 3.

In a similar way, the rest of the positions are calculated and the results arranged in order of importance. This order is simply the order of magnitude of the totals. Since *F* has a total of 2445, it is obviously the most important machine and, in case of conflict for position with another press, it must be placed first.

It could be said that we must find a proper placing of two conflicting presses by comparing their demand-position values in some quantitative way. However, physical limitations will far outshadow the small gains to be obtained by going any further into theory. Let it then be enough to say that we will place those presses with the highest demand values first, and then put the others as close as physical possibilities will permit to their correct demand-position mean.

The operations in their proper order of importance and showing their proper positions are:

Operation	Demand-position mean
F	3.9
Compute	6.5
C	5.6
A	3.6
B	2.7
Store	5.0
G	1.8
D	5.3
Degrease	8.5

Make the right plant layout . . . mathematically

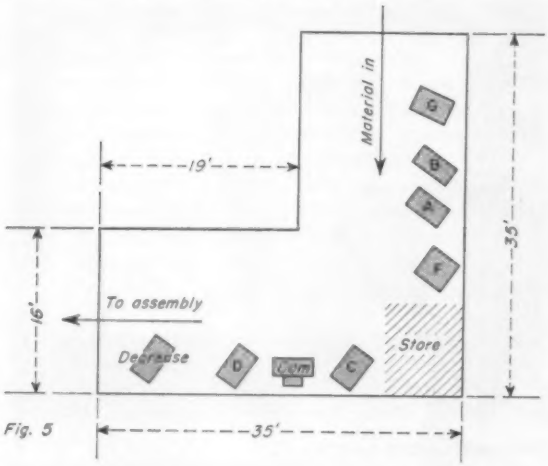


Fig. 5

Suggested layout . . .
. . . developed after demand-position investigation will insure minimum travel for all work to be processed

Fig 5 shows a possible layout. The presses are shown here all on one side, and press *D* is out of proper position to make room for the storage area and the computing station. It is not the purpose of this article to go into the arrangement further. We have clarified the problem, and from here on physical limitations will make the rest of the layout. The basic idea of the layout has been defined, and from this point on it is up to the men involved in the department to work from this basis toward the most practical grouping of the machinery.

The most usual situation one is faced with, however, is not in making a layout of a new department from scratch. Most layout problems are the result of people realizing that the present layout is not what it could be. By an adaptation of this system, we can evaluate any proposed change in the position of machines.

Suppose, for instance, that we have a machining department engaged in machining three different parts. As this is an intermittent operation (because it is necessary to change tooling) we must have a reasonably good storage area in the best position possible. The present layout is shown in Fig 6.

The line is for manufacturing a motor frame with two mating parts. Castings come to the area on pallets and, after the first operation, are put into cardboard containers. The problem is to rearrange the department to effect a saving, and to show what the saving will be.

The first thing is to find out the number of feet per year traveled at present. This is done by laying a grid over a scale drawing of the department. In this case the grid represents 4-ft squares. The operation sequence is then traced and the number of

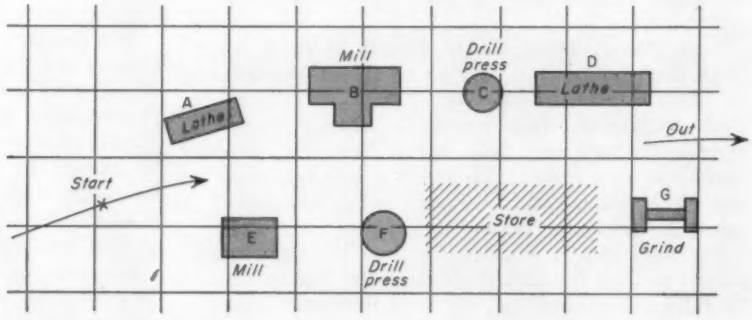


Fig. 6

Layout . . .
of a conventional machining dept for three parts, in which machines *A*, *B*, and *D* cannot be moved, can still be improved for increased efficiency

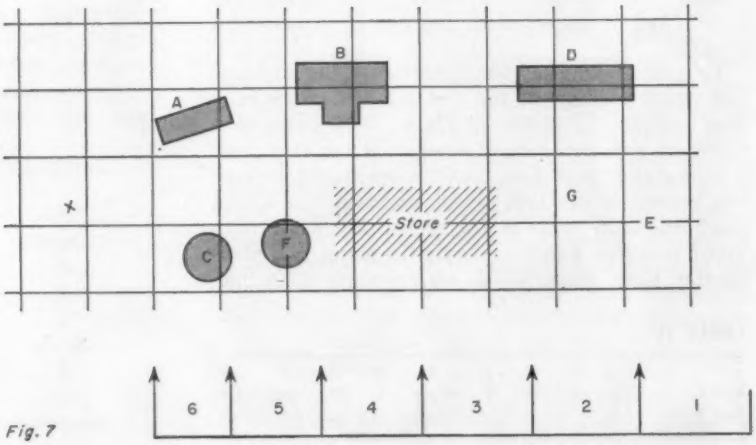


Fig. 7

Improved layout . . .
. . . results from study of distances traveled, as shown in Table V

feet traveled is recorded by counting the grid lines the part passes. The calculation is shown in Table V.

To explain this, consider the motor frame. From the starting point in Fig. 6, the part moves past approximately two grid squares to reach lathe *A*. From lathe *A* it moves past about 6 grid lines to reach *D*. Of course the actual distance could be scaled off, but the grid system is quick and easy to use. Then *d*, or the distance a box travels through the department is the total of these figures times four, since the grid squares are 4 ft.

The production per year is y, and the number per box is n. As we are interested in more than a ratio, y is treated as 65,000, the actual quantity.

A note here on the units used in the examples: It is immaterial if the units are changed. We can call y the number per year, day, or hour, and n, if it happens that the parts are moved individually, can be called 1, in which case the expression $\frac{dy}{n}$ becomes simply dy.

When the quantity $\frac{dy}{n}$ has been calculated, it is only necessary to find the best layout, as before.

As we have two parts with six machines, and one with four, we will spread out the third part as shown in Table VI. We will call *D* the third last operation, and Store, the fifth last operation, as was explained previously.

However, suppose that in this layout we cannot move the mill, *B*, the lathe *A*, or the lathe *D*. The reasons for this may be many, and it may often happen in layouts such as this that we cannot change part of the layout.

We therefore need not take these into account in our calculations. It is quite obvious that we cannot change the start or the ending position "Out". We therefore make up a chart (Table VII) similar to Table III and from this we establish:

$$F = \frac{5400 \times 4}{5400} = 4$$

$$\text{Store} = \frac{(2800 \times 5) + (6270 \times 3)}{9070} = 3.6$$

$$G = \frac{5400 \times 2}{5400} = 2$$

$$C = \frac{(7800 \times 6) + (870 \times 5)}{3670} = 5.75$$

$$E = \frac{870 \times 2}{870} = 2$$

Arranging these in order of importance:

Store	3.6
F	4
G	2
C	5.75
E	2

These values are used as the basis for the rearrangement. One likely layout is shown in Fig 7. The saving per year is then calculated, as in Table VIII.

From this, we see that on the existing layout Table V, we travel 739,000 box feet per year. The new layout cuts this to 642,000 box feet per year. This is a saving of 97,000 feet per year, or nearly 18 miles. So the move is worth while.

The obvious extension of this method is to apply it to punch press departments in which the presses are movable. The tendency toward this type of department is growing, and yet it is more difficult to move the presses into their correct positions than is at first thought.

Actually, the problem is the same. We have a multitude of parts and a few movable machines. How do we arrange the machines to best do the parts we plan to make?

In this case it is necessary to plan the quantities to be produced, and use the method on this short-term group rather than on a year, as was shown in the examples.

Mathematics will never, as some men presently fear, displace the ingenious man who knows intimately the processes with which he is concerned but the ingenious man is always thankful for new methods and fresh approaches. The procedure described above is offered as precisely that, not as a cure-all. The author welcomes any comment on the context or application to this method.

TABLE V

									d (Feet)	n	y	$\frac{dy}{n}$
Motor Frame	A	D	F	Store	G	Out						
Grid squares	2	6	5	4	3	2	=	22	88	12	65M	475200
Rear cover	A	C	B	Store	E	Out						
Grid squares	2	5	3	4	5	8	=	27	108	75	65M	94000
Top cover	C	Store	D	Out								
Grid squares	6	2	3	4			=	15	60	23	65M	170000
											total	739000

TABLE VI

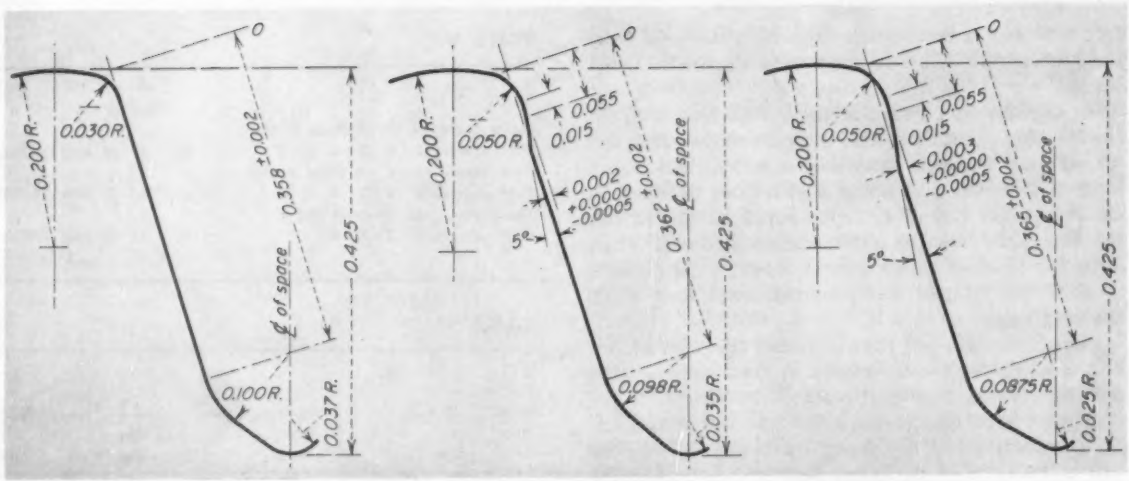
6	5	4	3	2	1	$\frac{y}{n}$
A	D	F	Store	G	Out	5400
A	C	B	Store	E	Out	870
C	Store		D		Out	2800

TABLE VII

	1	2	3	4	5	6	total
F				5400			5400
store			6270		2800		9070
G	5400						5400
C					870	2800	3670
E	870						870

TABLE VIII

									d	n	y	$\frac{dy}{n}$
Motor Frame	A	D	F	Store	G	Out						
	2	6	5	3	3	2	=	21	84	12	65000	455000
Rear Cover	A	C	B	Store	E	Out						
	2	2	3	2	4	2	=	15	60	75	65000	52000
Top Cover	C	Store	D	Out								
	2	4	4	3			=	13	52	23	65000	135000
											total	642000

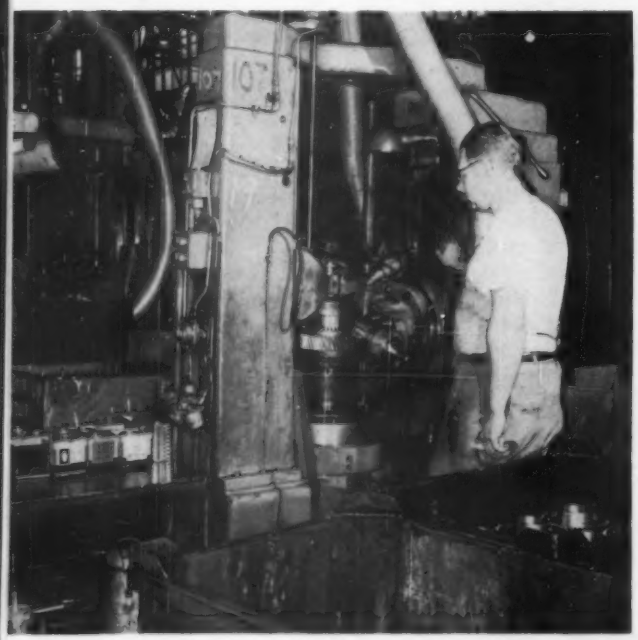


These three hob profiles handle all gears with 15 to 54 teeth, split up from 15 to 22, 23 to 34, and 35 to 54. Theoretically, gears with different numbers of teeth should be cut with different hobs, but these designs blend chamfers into active areas. Reduced hob inventory saves money

More Gearcutting per Dollar with Unground Hobs

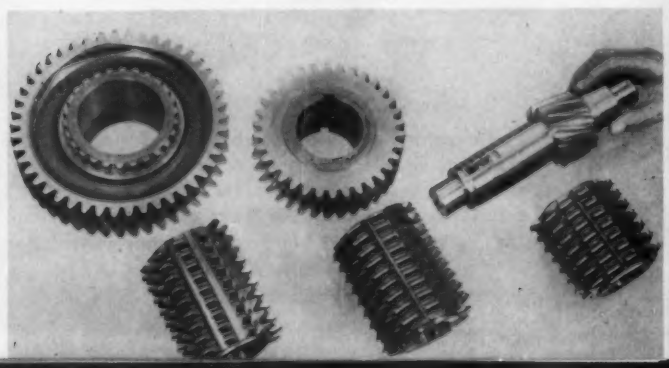
Dana Corporation cuts gears for trucks and other commercial vehicles at its Toledo plant, and uses formed cutters that are accurate, but not ground to final shape. This alone saves about 18% over form-ground hobs. Another cost saver is close control of the actual amount of stock removed when hobs are reground. Optical inspection shows how much must be taken off. Taking this, and no more, saves 20% in hobbing costs

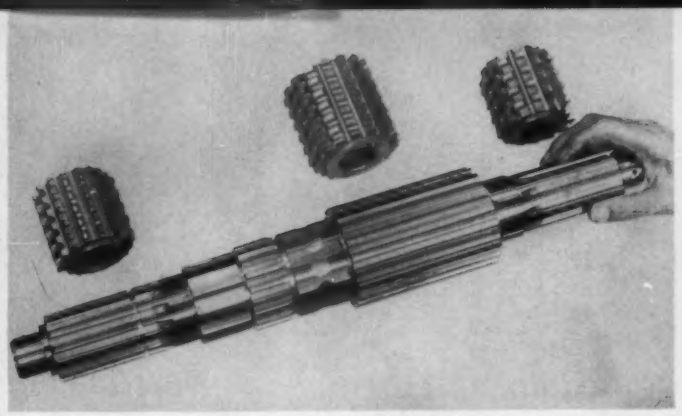
GEORGE H DE GROAT, associate editor

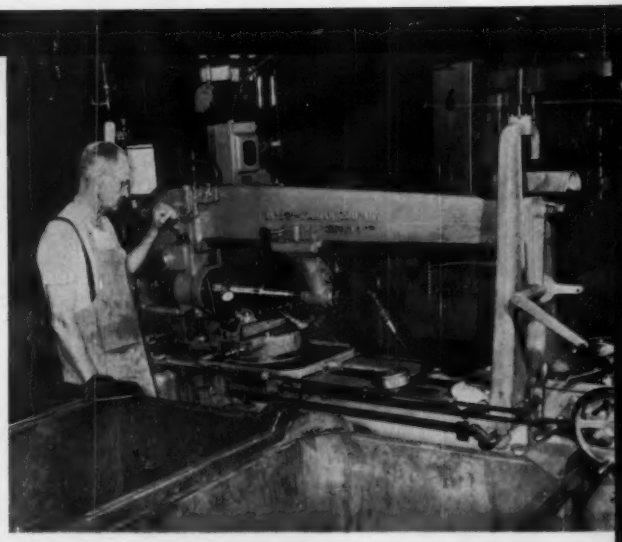


Gear-cutting machines are Gould and Eberhardt high-speed, single-spindle units that form both spur and helical running gears in large lots—semi-mass production. Cutters are single-thread and accurate, but unground. Depending on pitch and size, only 0.004 to 0.008 in. stock, measured over pins, is left for shaving

Basic hobs for 6-pitch, 17½° PA transmission running gears are protuberance, semi-topping types that generate a chamfer on the top edges of the gear teeth. Each basic hob, made by Star Cutter Co, is made in l-h and r-h styles to permit cutting l-h and r-h helix gears with hobs of the same direction







Involute and straight splines are also cut with unground hobs; on horizontal Barber-Colman machines. Two involute splines on the illustrated transmission shaft are 6-pitch, 20° PA, and the straight-side spline has 10 teeth. No tooth-finishing operations are necessary after the SAE 8625 heat-treated and forged shaft has been hobbed

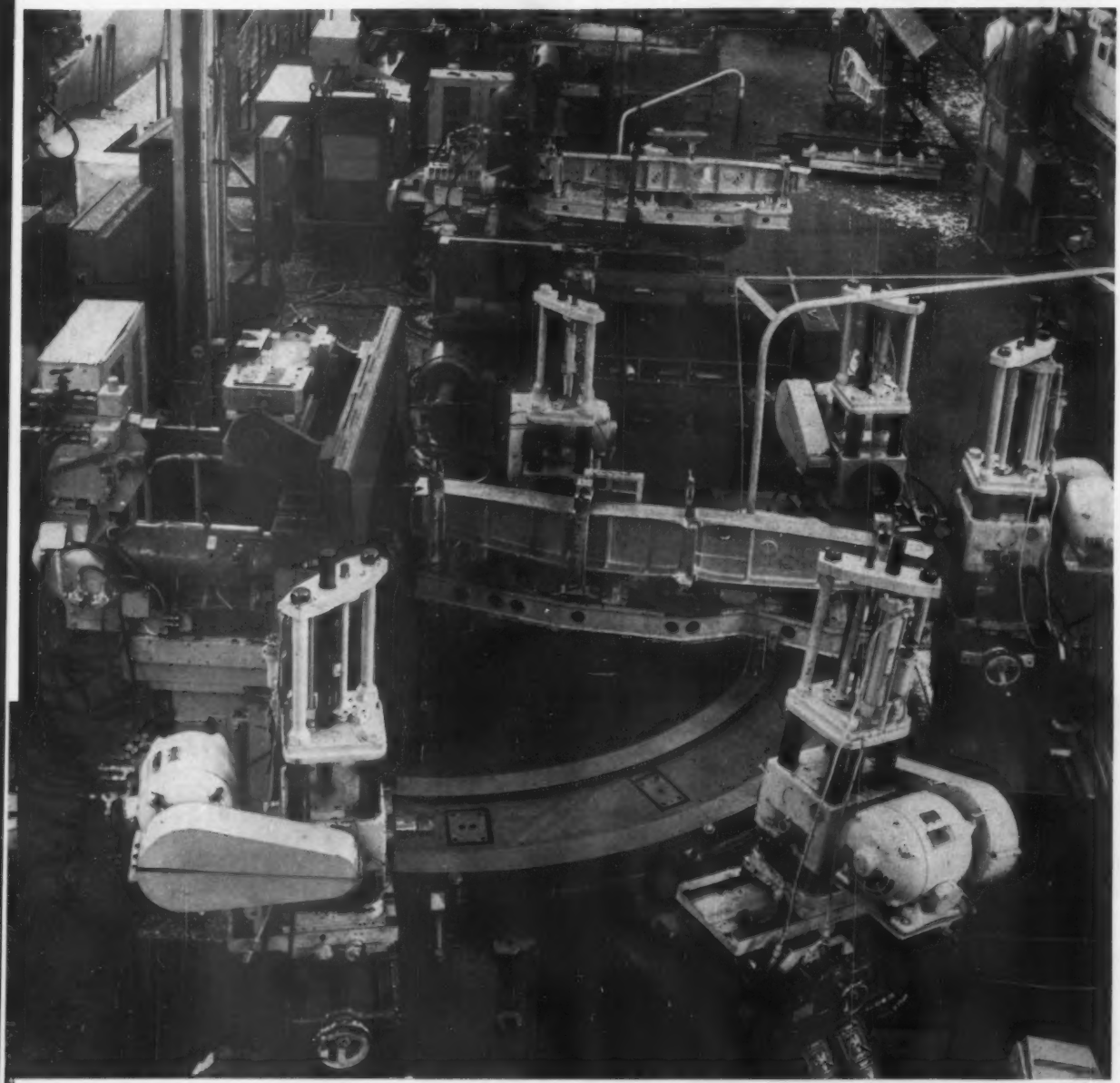
TOOL #		HOB #		PITCH			REMARKS ON BACK		
							NUMBER OF PARTS		
Date & Sym	Before Grind	Amt spec	After Grind	#Spl Teeth	Mach Type	Part Number	DAYS	2ND	3RD

Optical inspection of each dulled hob indicates how much peel-back is present; then numbered card matching that hob is filled out to show how much stock to remove in sharpening the hob. Card becomes permanent record for the hob, and will show history of stock removed at each sharpening. Card system tends to show up excess wear immediately, and indicates trouble at a machine

Hydraulic high-speed hob sharpeners, rebuilt by Star Cutter Co, have precision spindles and wet grinding equipment. They have reduced sharpening time and improved cutting-face surface finish

"Erector set" production line

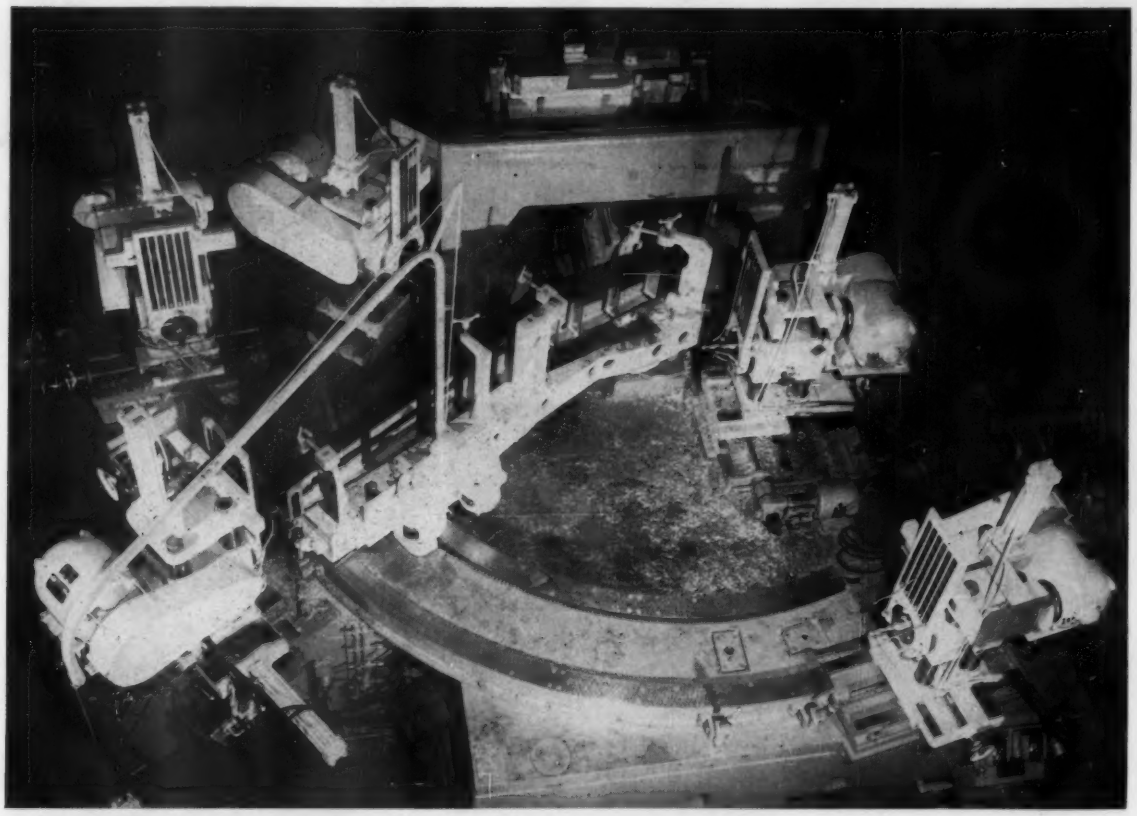
Machine bases, with heads positioned around them, gives North



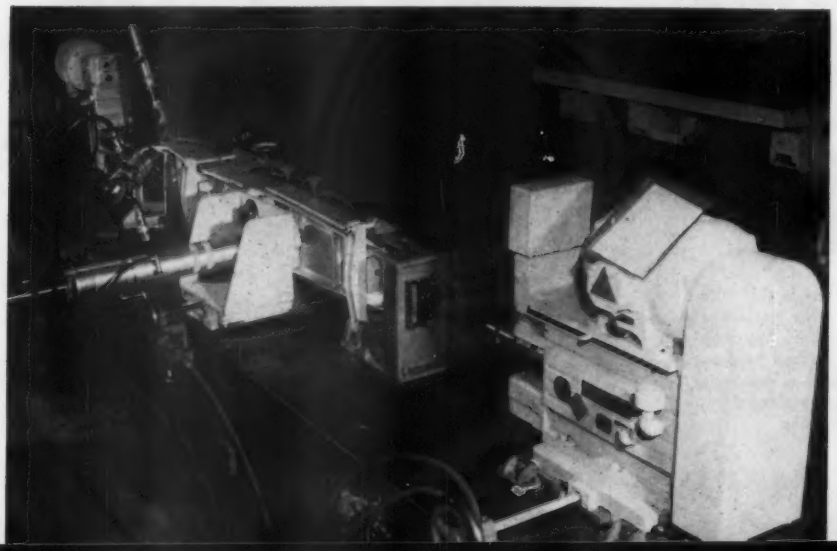
More than a year ago, initial machines of this line were designed and built. The principle has proved so successful that several parts are made this way. Here is the major setup for the main center-section spar on the F-100, *Super Sabre* day fighter. This is a heavy aluminum forging requiring drilling, milling, spotfacing, and like operations, principally on the ends. In the machine in the foreground (and on our cover), the forging is clamped in a fixture that can be indexed about a pivot at one end. Machining heads spaced around the arc perform the various operations in turn. Included is a duplicating setup (left) that mills the pivot end while other operations are going on

speeds design changes

American Aviation, Inc, Los Angeles, flexibility with low costs

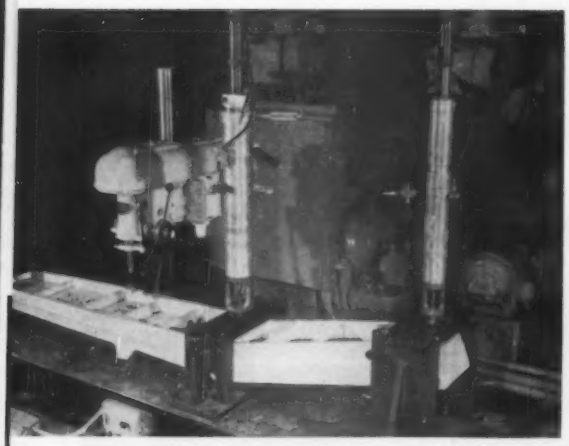


Layout of the heads on the indexing machine is perhaps clearer in this view taken from above. Note that two heads work opposite ends of the forging in position 1, a single head in position 2, and two heads again in position 3. The duplicator can be cycled in separately as desired. Additional heads can be added if needed, of course

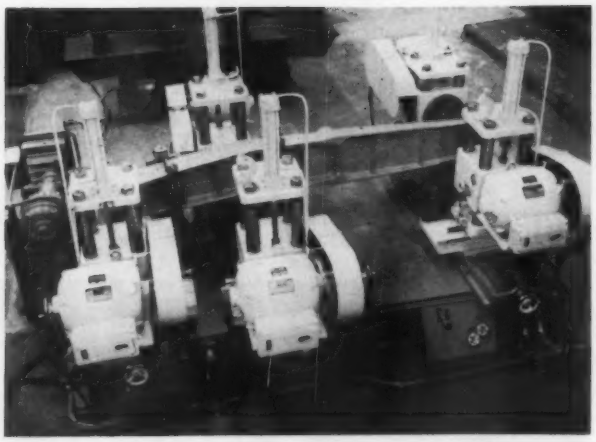


A more familiar type of setup is this one, with three air-drilling heads placed for angular holes and two motored heads drilling from the ends. The base is a standardized flat-top table, so fixtures and tools can be reset in a few hours

PLEASE TURN PAGE ►

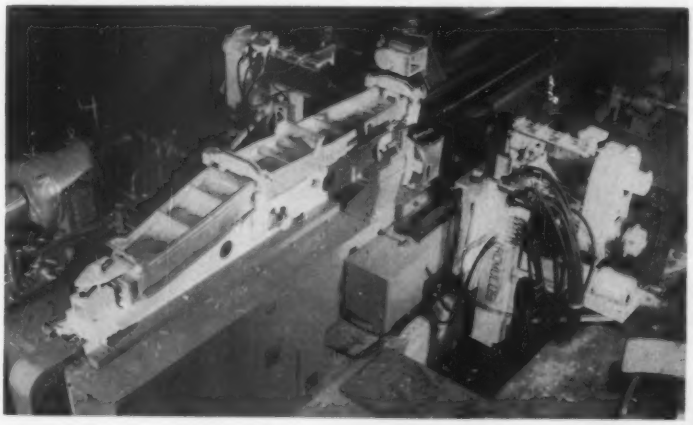


Another mixed-type setup is this vertical one, with two air heads and a conventional drillpress head, all doing counterboring operations. Here, again, the fixtures are readily movable



Milling operations can be done simultaneously at five points by these plug-in heads, each with its own 3-way adjustment and feed. These heads are Master "lathe converters," designed for milling on a lathe

"Erector-set" production line . . .

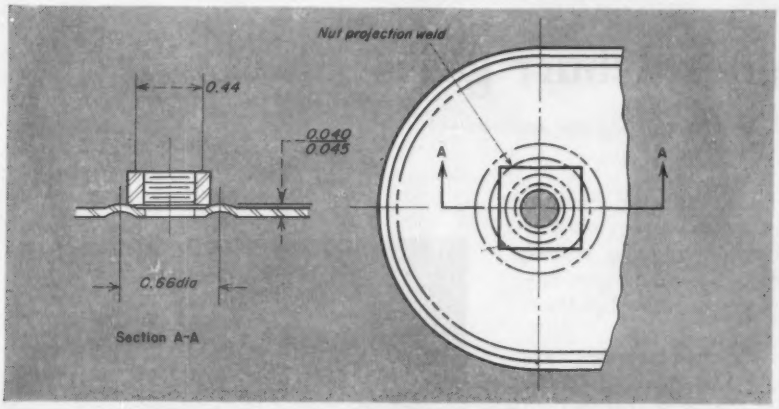


Line milling of top and bottom on the forging is done on this hydraulic-feed fixture, which passes twin Romulus duplicating heads. Guided by templets, they can follow part contour as it is fed past them

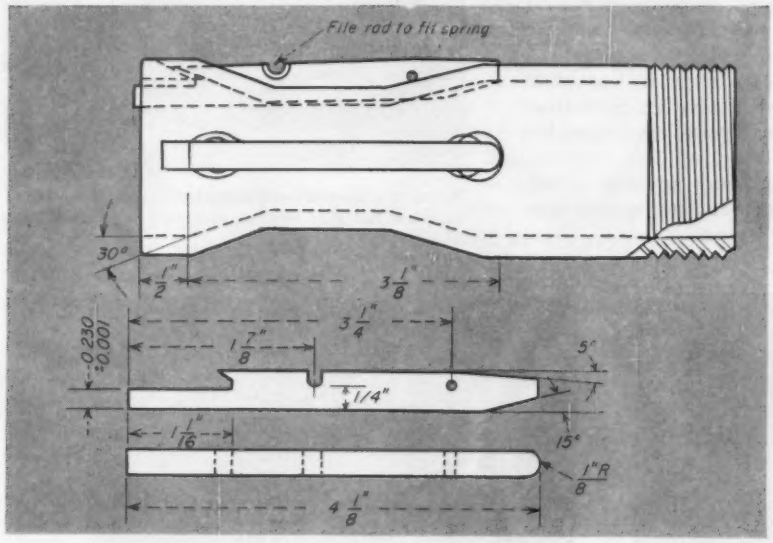
Only hand operation on the line is this trunnion-fixture setup for routing the upper surface of one web. It could be done automatically, but variations in design and low cost of this method have not yet justified it. There are also several conventional setups in processing this part, but they are not shown here because they reflect familiar practice

New ideas speed Chevrolet production

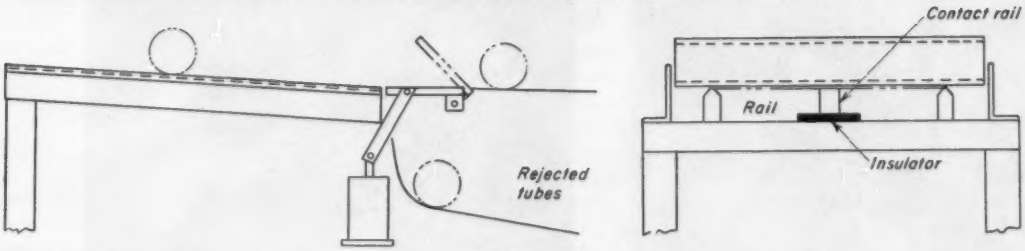
New techniques developed at Chevrolet's Cleveland plant for speeding production of 1957 automobiles were reported on in a recent issue (*AM*—Oct 22 '56, p 137). Here are three more ideas which have been adopted to improve production



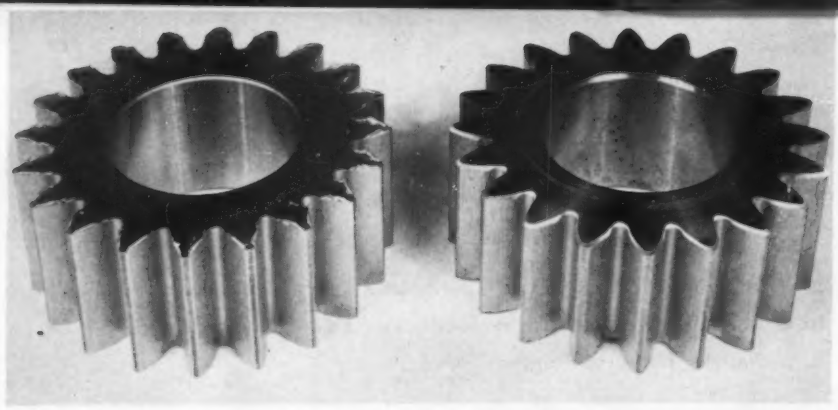
1 . . Special nuts are eliminated . . . in sheet-metal assemblies with this construction. Embossed section around a pierced hole provides material for projection-welding a standard nut to a part. Previously, nuts were dimpled for this operation or were made with bosses to facilitate joining to sheet metal



2 . . Bar-stock scrap ends... can be shorter with this Chevrolet development for use in automatic bar machines. Pusher collet is equipped with three fingers that collapse into the walls as bar is fed through, but grip the end closer than an ordinary collet does. Scrap ends ordinarily about 6½ to 7 in. long are thus reduced to 3¼ in., amounting to considerable materials savings in high-volume production



3 . . Automatic checking . . . for straightness of tubes eliminates previous necessity for 100% check at straightening machines. Because only a portion of the tubes actually need straightening, the majority were put into the machines without need. Now tubes roll across a table on two rails where a center bar, insulated from the rails, is used to close an electrical circuit. The center bar is a few thousandths in. lower than the rails, so that a bent tube contacts it, closing the circuit and exciting a cylinder to open a trap. Bent tubes drop through the trap and are delivered to straightening machines. Straight tubes that do not contact the center bar skip the operation



Deburring makes this much difference . . .
on 3¾-in. spur gears. Time was 12 sec per side

Two little machines deburr gears

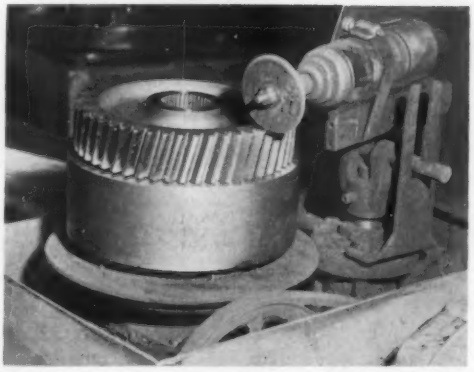
DICK J WEAVER, mfg methods development dept, transmission operations
ALLISON DIV, GENERAL MOTORS CORP, INDIANAPOLIS

Hand deburring is a wasteful operation, but it is difficult to mechanize. In a plant where many special deburring machines have been installed for large production orders, equipment to deburr short runs had to be inexpensive, adjustable, and easy to operate . . . in short, just what these machines are.

Deburring is not precise, because the chamfer angle varies from tooth tip to root as the grinding wheel rises and falls, following the gear contour. But results are better than hand work, at that. Deburring is done just before final gear shaving, so any burrs left from the deburring operation are removed later.

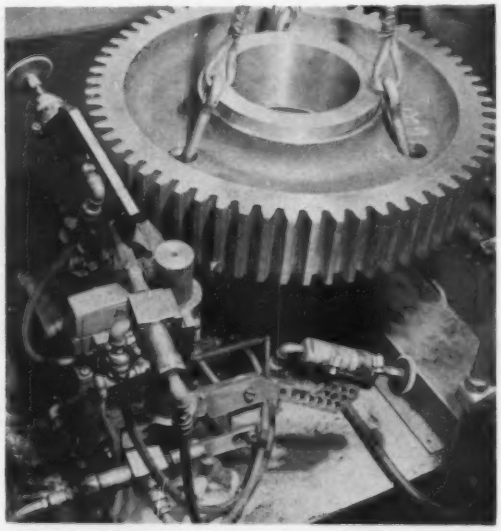
Costs have been reduced. In some cases operators of nearby hobbing or shaving machines can handle deburring; in any case, the machines have short cycle times. Also, the machines cost little to build.

Wheel life is from three to four hours on small gears. Wheel dressing is not necessary because the varying contours of the gears keep the wheels dressed.



Machine is semi-automatic . . .
timed for full gear rotation by means of powered turntable

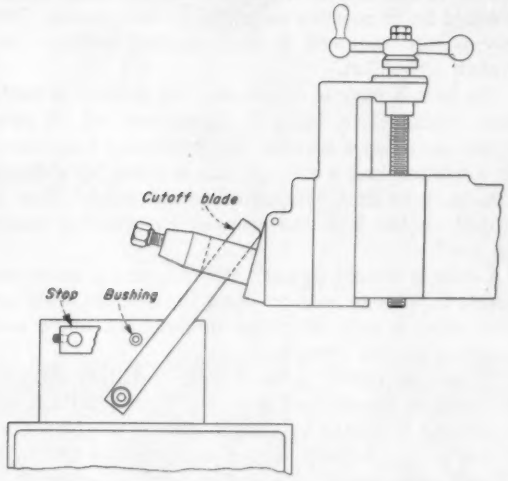
Larger deburring machine . . .
has two pneumatic grinders working at same time to get top and bottom edges. Wheels are nylon-reinforced, 80-grit, and 3 in. in dia. Gear rotates slowly to prevent wheel bounce; sits unclamped on nesting fixture



Grinders flip out of the way . . .
when large gear is loaded on machine. Arms that carry grinders are counterbalanced by air cylinders, and can be adjusted for different gear sizes. Cycle time for 30-in. gears is 75 sec

Practical Ideas . . .

Shaper Substitutes For Press



Some time ago when I needed a press to cut a large quantity of rod I found all our presses tied up. It was then that I designed this unconventional cutoff fixture to be used in a shaper.

The main body of the fixture is a square plate drilled to receive a drill bushing through which the rod is fed. Another hole is drilled and tapped for a stripper bolt, providing a fulcrum for the cutoff blade. A rod to carry the adjustable stop is fixed in a convenient location.

The fixture is secured in a shaper vise. The ram of the shaper is adjusted for length and location of stroke. The cutoff blade is loosely held in the toolpost with the toolpost screw left idle. The stop is now set to the proper rod length and the cutoff fixture is ready to use.

The operator keeps feeding the rod against the stop while the shaper runs continuously. Speed at which the rod can be cut is limited only by the operator's ability to feed.

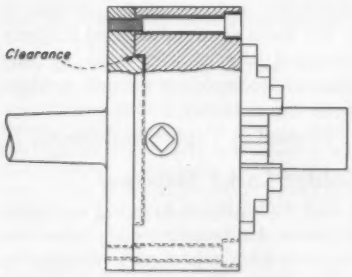
George A Jonas, Glen Oaks, NJ

Floating Chuck Speeds Setup

A runout, however slight, is inevitable with work mounted in a three-jaw chuck. This is a situation that can't be tolerated in grinding work, where it sometimes is necessary to set up a job just to remove 0.001-in. or less.

My method of assuring concentricity deviates from normal practices, but has worked fine in external and internal grinding as well as on light turning.

The chuck is mounted on an adapter plate as usual, but with 1/32-in. clearance between the dia of the boss and the undercut on the



back of the chuck. The mounting holes are also given additional clearance whether the screws are inserted from the face of the chuck or through the adapter plate. This provides a means of adjusting the chuck to within 0.0002-in. concentricity.

The mode of procedure would then be to mount the work-piece in the chuck, correcting it longitudinally with the help of an indicator. With the indicator still in contact with the work, the chuck is slowly rotated and the high-spots equalized by tapping the side of the chuck with a block of lead.

The correcting is done while the screws are merely nipped. When the desired position of the chuck has been found, the screws are securely tightened.

This approach has also been used with good results on square pieces with a four-jaw chuck, but very little of that work comes along lately.

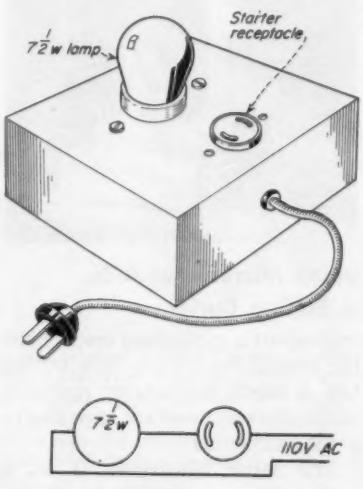
John A Kramer, Detroit, Mich

Simple Tester Checks Fluorescent Starters

Although old fluorescent fixtures using starters are on their way out as they are replaced by the instant or rapid starting lamps, there are probably millions still in use. It is to the maintenance men of such fixtures that the illustrated tester should be of value.

Much of the trouble with these lights can be traced to the starter, but definite blame is not easy to establish without some means of checking them. I have made this tester for use in our shop, and it has eliminated the guesswork for me.

A small chassis or box was made from sheet metal for mounting of the parts. Two holes were punched; one to take a porcelain receptacle

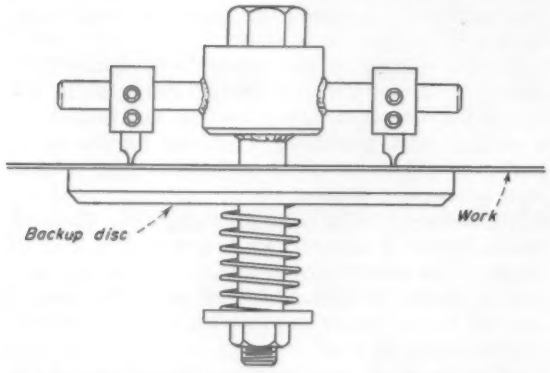


for a 7½ watt lamp, and one for a starter socket. These were wired in series with a line cord and connected to 110 v AC source.

To test a starter the lamp is screwed into its receptacle, and the starter placed in the socket. A good starter will not light the lamp, but a bad shorted one will cause the lamp to glow.

Charles W Shutt, Alma, Mich

Circle Cutter Is Powered By Hand



We have several circle cutters in our shop which we use in a lathe or drillpress. Attempts have been made to use them in a portable electric drill when the job couldn't be moved, or when it was too big for the drill press and lathe. This experiment was abandoned because it was impossible to hold the spindle of the drill perpendicular to the work.

The circle cutter illustrated is one we made to enable us to cut a hole anywhere without electric power. It will also do a job in a limited space where it would be impossible to introduce machining. The only power required is that applied with a box wrench or racket.

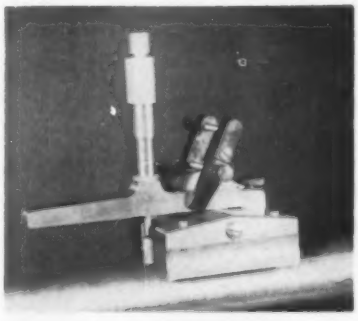
The unit is easy to construct. The spindle is made from a long ⅝-in. bolt, its thread cut off. A new thread is cut on a smaller dia, providing a shoulder for a washer and a nut. A hub is made by drilling a ⅝-in. hole in a section of round stock. This is slipped on the bolt and secured by welding under the head.

A hole is drilled through the hub, and a cross bar inserted. This is held in place by a small weld on each side. A pair of cutter holders are made and mounted on the cross bar.

To use the cutter, a ⅝-in. hole is drilled through the work at the desired location. The spindle is inserted and is guided by a large disc on the back face of the work. A fairly heavy compression spring is slipped over the spindle and a nominal pressure is applied by the washer and the nut.

The cutting is done by rotating the hexagonal head with a wrench until the hole is cut through.

Clifford Malloy, Bronx, NY



Depth Micrometer Aids In Setting Cutter

In place of a specialized instrument for setting the cutters in a boring bar, a depth micrometer mounted on the base of a surface gage makes a good substitute.

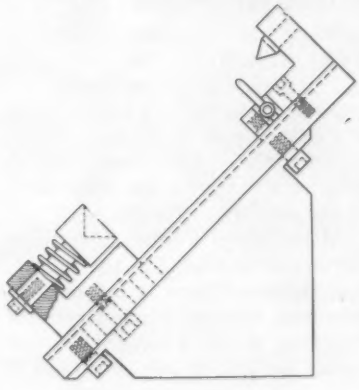
The setup illustrated is on a boring bar mounted in a milling machine. The depth micrometer is securely fastened to the adjustment bar of the surface gage. This also provides a means for zero adjustment. The surface gage is located on the bar by the V-groove in its bottom surface.

A preliminary measurement is taken from the peripheral surface of the bar. This gives us a basic reading for correct radial setting of the extreme end of the cutter bit. After a short trial cut has been made, the actual dia produced is checked and the instrument is again used to make any necessary correction in the cutter setting.

H J Gerber, Stillwater Okla

Fixture Aids In Producing Uniformly Sharpened Reamer Flutes

On the pressed metal parts we manufacture, hubs are installed which must be reamed to fit a shaft. Consequently our reamers are constantly at work and need frequent resharpening. For the purpose of simplifying this job the illustrated fixture was made. It can be mounted on the chuck of a surface grinder or any other precision grinder capable of holding it.



The legs holding the fixture at 45° are two plates screwed to the underside of the base. Two centers are mounted on the base: One stationary male center, and one spring-loaded female center, or retainer which is adjustable.

Near the male center is an adjustable stop. This can be raised to reduce the clearance on the cutting edge, or lowered to increase it.

We have squared off and slightly rounded the shank ends of our reamers to insure a smooth contact with the retainer.

Edward R Tayler, Galesburg, Ill

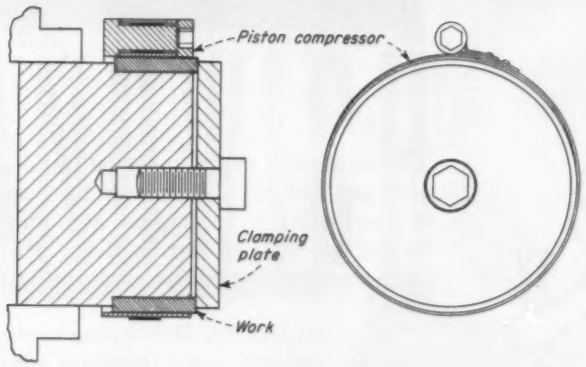
Solder Locks Setscrew

I had difficulty in keeping a vitally important setscrew tight. After vibration had repeatedly worked it loose, I stumbled on a desperation measure that actually worked.

A blob of solder was first dropped into the hole, and the setscrew was forcibly tightened on top of the solder. This forced excess solder into threads, locking the screw securely.

Ed Mayover, Bradenton, Fla

Ring Compressor Saves Bushings



We had just completed machining a considerable number of thin-walled split bushings when it was discovered that the OD was too large. To discard them and make new ones would have caused a loss in both man-hours and material. With an aim to salvage the bushings, the illustrated gimmick was tried and found successful.

A stub arbor and clamping plate were made. The OD of the part-holding section of the arbor was turned to the same dia as the original ID of the bushings before splitting. The dia of the clamping plate was made slightly smaller than the required OD of the bushing.

To mount a bushing for machining, it is first slipped on the arbor. A piston-ring compressor is then applied over the bushing and tightened, forcing the bushing to conform to the arbor. The screw (or screws) in the clamping plate should then be tightened to hold the bushing concentric with the arbor. The compressor is removed and the bushing is machined as required.

Ring compressors can be purchased in various sizes ranging from 1½ in. to 7 in. and perhaps even larger.

Milton Simpson, Royal Oaks, Mich

Cloth Stabilizes Drill

Sometimes a drill chatters or walks around the edge when you try to open a hole to a larger diameter. This happens more often when the drill is long and unsupported. It doesn't always cause damage, but I've made it a hard-and-fast rule to drill through a folded piece of cloth—or abrasive cloth—when this happens.

The cloth pad also assures concentricity with the original smaller hole.

Ron Smith, Rio du Loup, Quebec

***Winner No. 266* IN THE DECEMBER 31, 1956 ISSUE**

RECEIVED $25 *IN ADDITION TO REGULAR PAYMENT*

For the best PRACTICAL IDEA

- **Ottavio Cerullo,** East Boston, Mass **'Centerless Pin Grinding'**

A SPECIAL ANNOUNCEMENT!

Additional yearly prize of $100.00

for the best Practical Idea published between Production Planbook issues . . .

Every contributor to Practical Ideas will now be eligible for two prizes; the regular $25.00 prize awarded for each issue, and a second Grand Prize of $100.00 to be awarded to the author of the Practical Idea judged the best in each Production Planbook. Planbook Practical Ideas are reprints of all the $25.00 winners published through the year; thus the winner of the Grand Prize will be a winner of winners. Rules for the Grand Prize contest will be the same as for the contest in each issue, except that the ideas considered must qualify by winning the $25.00 prize in the issue in which they originally appeared. Duplicate prizes will be awarded in case of a tie vote. Reader vote will be considered final.

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT — $25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received — usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS — Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author — every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y

Round Table...

Brainstorming in the shop

DO PROGRAMS to familiarize employees with the product and its problems ever have results? Or should Malone leave the engineering to the engineering department? Your opinions may help guide others. Discussions of earlier topics start on page 234

"I wish Malone would knock off this classroom stuff and get his department back to work. He's not going to accomplish anything by educating his men on our products. He should leave the thinking to the engineering department."

"You're all wet, Ed. He's trying to stir interest in the product, and I think it's a fine idea. He's bound to get some suggestions about the equipment we make, besides getting the men more interested in turning out better quality."

"Al, don't you think the men see enough of our products while they're working on them? They probably get sick and tired of the whole business. Besides, what kind of ideas can they think up? The men aren't experienced in design or methods engineering. It's a waste of time—and money, too. It's an hour of loafing—with pay—for every man in Malone's department."

"Look, Ed; even if Malone only gets a couple of good ideas it's worth the time and trouble. If he can pass along some better production technique to the engineering department, it might pay for the class many times over."

"And somebody might figure out a way to eliminate the product entirely, too. Why doesn't he concentrate on getter closer inspection and better equipment—as well as better workers. That might make a difference. I don't think this educational program will."

"Well I do, and I'm going to ask Harrison about letting me try it. Listen, Ed; if we could get a couple of hundred men thinking about a way to improve that miserable catch on the Model 71, we might get somewhere. So far, the bunch in Engineering hasn't been able to lick it."

"I'm surprised at you, Al. I thought you were the one with all the confidence in higher education; and now you're asking a gang of average men to solve a problem they can't lick upstairs."

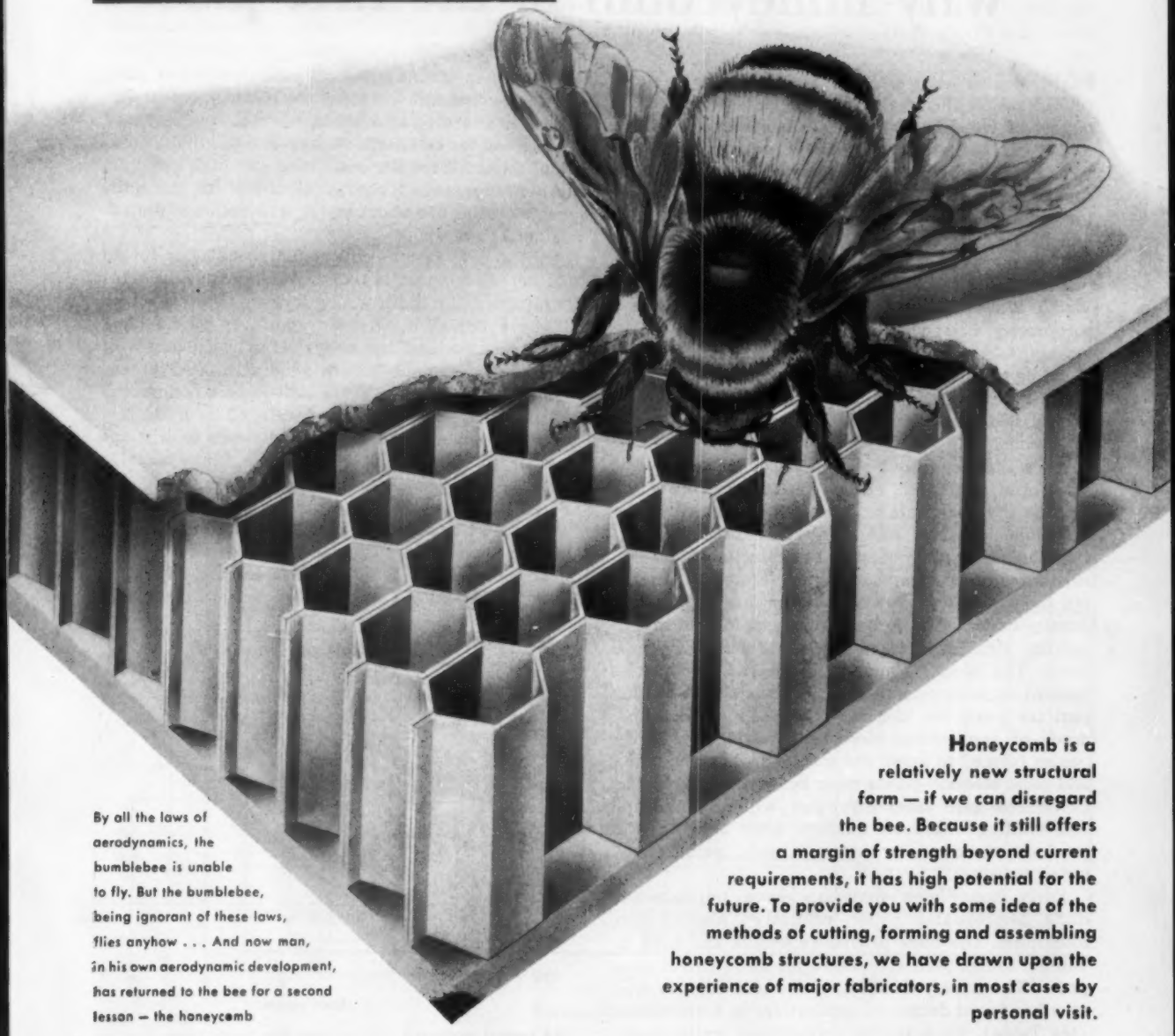
"I haven't lost confidence, Ed. It's just that the men in the shop have ideas, too; and we ought to encourage them to think about what we're making here."

• • •

American Machinist

SPECIAL REPORT NO. 441

HOW TO MAKE SANDWICH



By all the laws of aerodynamics, the bumblebee is unable to fly. But the bumblebee, being ignorant of these laws, flies anyhow . . . And now man, in his own aerodynamic development, has returned to the bee for a second lesson — the honeycomb

Honeycomb is a relatively new structural form — if we can disregard the bee. Because it still offers a margin of strength beyond current requirements, it has high potential for the future. To provide you with some idea of the methods of cutting, forming and assembling honeycomb structures, we have drawn upon the experience of major fabricators, in most cases by personal visit.

E J TANGERMAN

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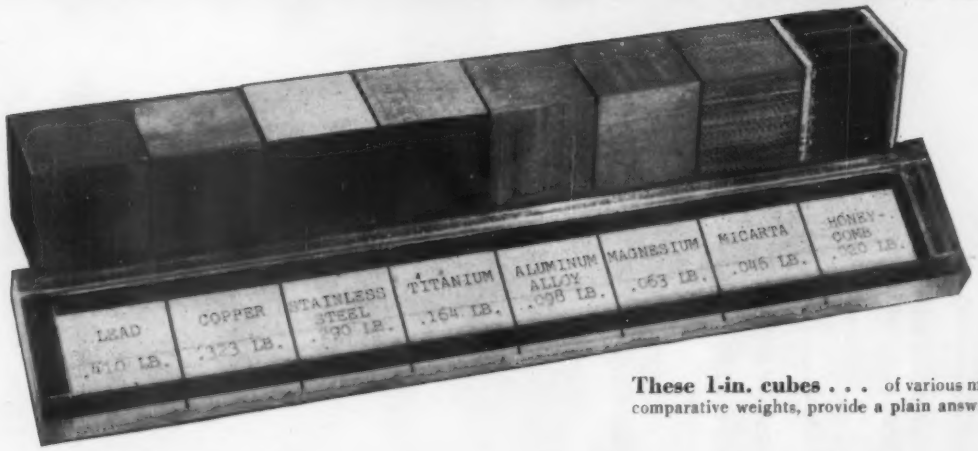


Convair—Fort Worth

These 1-in. cubes . . . of various materials, with their comparative weights, provide a plain answer to the question.

Why honeycomb in the first place?

Flight of a modern airplane or missile is the successful result of cumulative struggles to pinch out ounces of weight in the structure, for every ounce taken out means added ounces not required to strengthen the structure to carry that ounce and the fuel necessary to fly it a greater distance. Savings for each ounce not needed may be 10 oz in flyaway weight. Designers have long used tubular, box, truss and hat shapes to get stiffness with minimum weight.

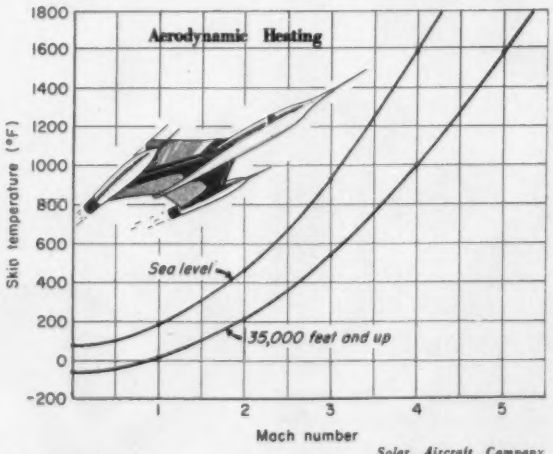
The British, facing material shortages early in World War II, designed the *Mosquito*, which incorporated balsawood sandwich elements—outer strength skins of thin birch held apart and from buckling by an ultra-light balsa-wood filler. Chance-Vought incorporated the idea in a dural-faced sandwich called "Metalite" and used on the Navy F5U, F6U, and F7U.

Since then, countless variations of the sandwich have been attempted, employing for the core such low-density materials as balsa, cork, foamed plastics, foamed glass, and many fabricated cellular structures. Formed shapes have included waffle, sine-wave or corrugated sheet, egg-crate and others, but the most successful combination has been high-density materials in foil-thin ribbons, formed into a cellular structure resembling the familiar honeycomb. The Martin Company pioneered the development of honey-comb-core sandwich, and in the past ten years the idea has widely appeared. Hundreds of applications have been made, new companies formed to make the core and the assemblies, and most aircraft plants have honeycomb divisions. Contoured assemblies for outer wings, stabilizers and trailing edges on missiles were early major products, followed by aircraft parts, particularly radar housings.

Early honeycomb materials were impregnated duck, impregnated paper, reinforced plastics and aluminum. The duck proved expensive and hard to handle, so has been abandoned for all practical purposes. The paper, cheap to make and easy to use, now has found dozens of applications in architecture (see Table), truck bodies, refrigerator walls, doors, and similar places, but is beginning to yield to other materials in aircraft. Paper, glass-reinforced plastics and aluminum are today the common core materials for aircraft and missiles, the first for cheapness, the second for electronic reasons and thermal insulation, the third for fire resistance and high strength. (Aluminum is much cheaper than plastics, strength-weight ratios are about equal, and both are fire resistant.)

But a new factor—supersonic speed—has forced further developments. At high speeds, skin temperatures go up to surprising levels—1000 F at Mach 4 above 35,000 ft. Organic adhesives which bond the structures and the materials of construction of familiar honeycomb are in general limited to operating temperatures below 450 F. But honeycomb of stainless steel (originally developed by Budd Mfg Co) or titanium, brazed into sandwiches with stainless or titanium skins, extends the range of such structure to 1200 F for 17-7PH stainless and 800 F for titanium, providing the only practical sandwich with a margin for tomorrow's designs.

Latest candidate, still in the lab stage, is a ceramic honeycomb, made complete with ceramic skins and able to take 2000 F in repeated heats. Strength of



Solar Aircraft Company

As speed goes up . . . so does skin temperature. Here external heating is plotted as a function of speed

the completed sandwich is 25,000 to 30,000 psi in compression. Continental Can Co developed first an asbestos honeycomb for firewalls, bonded with an inorganic cement to CA asbestos board. This will stand 1700 F for 40 min., is expected to stand 2200 F when development is complete.

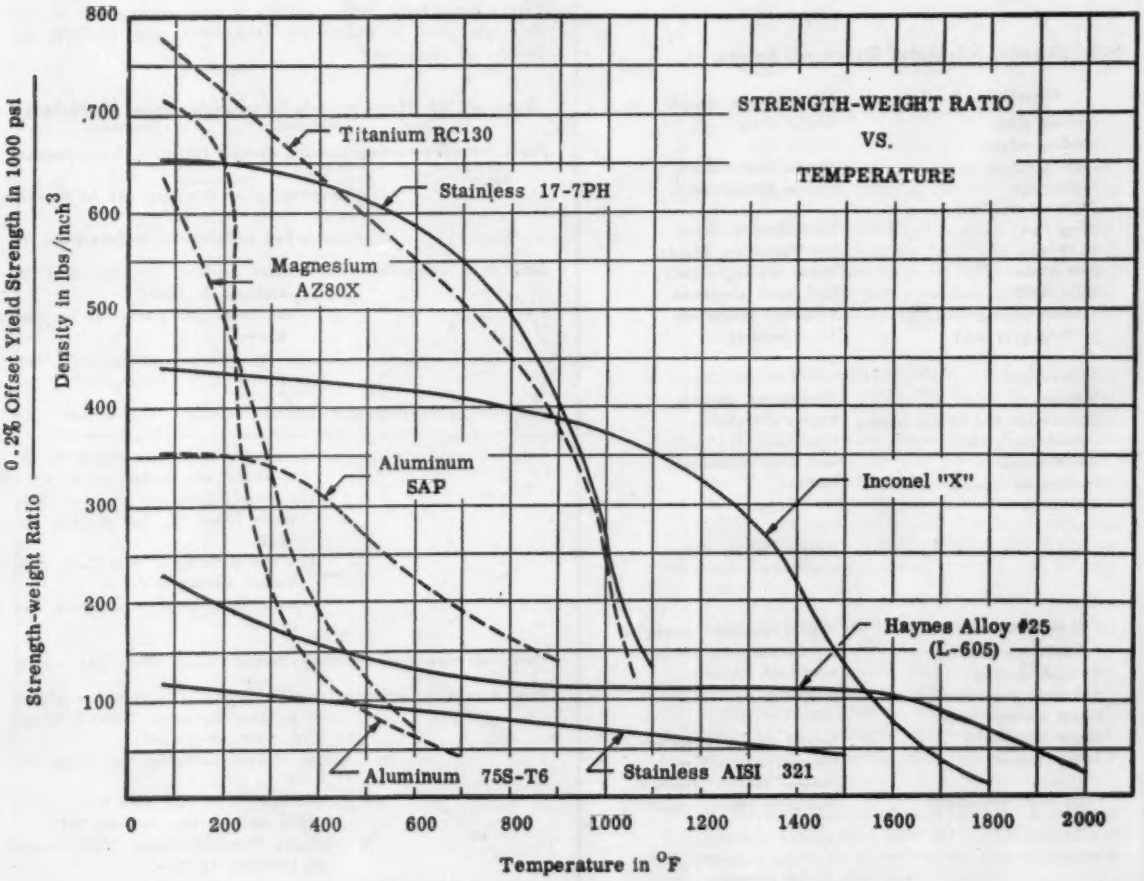
The ceramic sandwich is an outgrowth of this. A long-fiber asbestos paper, formed as a square or hex honeycomb core, is dipped in an alumina. Skins, similarly made, are applied and the assembly fired at 3000 F. This burns out the asbestos and paper except the long fiber, leaving actually a double wall that totals about 0.020 in. thick, and weighs 2 to 2½ lb per sq ft for a sandwich 1 to 1½ in. thick.

Shapes such as missile noses can be formed and necessary holes cut before firing, but once fired the sandwich cannot be formed, nor can it be cut with anything except a diamond tool. Tolerances can be held to about ±0.005 in. The sandwich made thus far softens at a bit over 3000 F, but it is still able to withstand a far higher temperature than presently available materials. A ceramic nose, coupled with an asbestos body (of the asbestos type of honeycomb), could withstand any anticipated atmospheric temperature which a missile will encounter.

Honeycomb construction reduces weight and number of parts; simplifies fabrication and assembly; reduces tooling, floor space, over-all time, and costs per pound; cuts repair and rework; improves aerodynamic smoothness, rigidity, reliability and structural efficiency. It increases the need for process control, because every step is critical, but it can cut over-all man-hours, hence cost.

For the *Matador* missile, Martin makes a wing pair of fewer than 500 parts, while a stabilizer of conventional design and comparable size has 3000 or more. For the F-86D fuselage speed brake, North American Aviation formerly had a corrugated inner skin riveted to an outer skin. Redesigning this curved structure for honeycomb cut weight from 26.5 to 18.5 lb, or 30%. Cost rose 14%, so cost per lb for the weight saved was $6.38. This is fairly typical.

Thus the sandwich structure is likely to be with us for a long time and to find applications on products other than aircraft where a high strength-weight ratio is necessary. Because the unfamiliar methods in fabricating it are legion, some effort should be made to outline their solutions for Metalworking in general.



Solar Aircraft Company

Strength-weight ratios . . . of many light alloys drop off rapidly with temperature. Above 300 F, stainless and titanium alloys begin to show advantages

Applications, Adhesive-Bonded Honeycomb Sandwich

Aircraft

Fuselage
Access door
Bulkheads
Flooring

Wings
Wing tips
Wing fences
Trim tabs
Control surfaces

Leading edges
Trailing edges
Flaps
Bomb-bay doors

Commercial

Walls, partitions
Concrete forms
Roofs
Doors
Tables

Railway cars
Boats, barges

Missile bodies
Missile fins

Ducting
Insulation layer
Rotor blades
Fuel tanks

Radio antenna housing
Radar housing
Radar reflector

Shear webs
Store supports
Fairing
Shelving
Splitter panels

Truck bodies
Truck trailers
Refrigerators

Shipping containers
Pallets
Plastic tooling

Shelving

Applications, All-Metal Structural Sandwich

Aircraft

Aircraft skins
Leading edges
Trailing edges
Empennage
Flight control surfaces
Wing tips
Wing ribs
Dive brakes
Belly landing pads
Exhaust blast panels
Landing gear door

Inlet scoops
Ducting
Compressor and turbine blades
Ducted-fan blades
Guide vanes
Compressor casings
Tail cones

High-pressure, irregular tanks
Missile skins
Missile fins
Missile nose sections
Engine compartments

Pressurization doors
Boundary-layer bleeds
Sweat cooling panels
Fuel tank structures
Vibration dampeners
Shock mounts

Fluid heat exchangers
Afterburner shrouds
Engine shrouds
Firewalls
Anti-icing structures
Mufflers
Thrust reversers

Marine components, corrosion resistant

Commercial

Exhaust flue ducting
Vacuum ducting
Externally pressurized tanks
Liquid storage tanks
Large fan blades
Screen support

Fluid heat exchangers

High-temperature insulation
Low-temperature insulation
Acoustical insulation
Insulating vacuum flasks

Impact energy absorbers
Microwave reflectors
Nuclear reactor structures
Drainable reactor shielding

George D Cremer, Solar Aircraft Company

North American Aviation

The Christmas bell . . . is a familiar example of the technique used in honeycomb fabrication, and similarly indicative of lightness

Sources of Honeycomb-Sandwich Core Materials

Paper, adhesive-bonded—Douglas Aircraft Company, Santa Monica, Calif
Continental Can Company, Inc, Mt Vernon, O
Union Bag & Paper Co, Hudson Falls, NY

Glass cloth, adhesive-bonded—Hexcel Products Inc, 951 61st St, Oakland 8, Calif
Continental Can Company, Inc (see above)
Narmco Mfg Company, 930 West Grape St, San Diego, Calif

Aluminum, adhesive-bonded—Hexcel Products Corporation (see above)
Honeycomb Co of America, Burroughs & Noble Sts, Bridgeport 8, Conn
Honeycomb Structures Co, Inc, 5508 West 102nd St, Los Angeles 45, Calif
L A Young Spring & Wire Corp, 9240 Russell, Detroit, Mich
Narmco Manufacturing Company (see above)

Steel, adhesive-bonded—Hexcel Products Corporation (see above)

Steel, brazed or welded—Hexcel Products Corporation (see above)
John J. Foster Company, 19666 S Harbor Blvd, Santa Ana, Calif
Solar Aircraft Company, San Diego 12, Calif
Specialties Inc, Syosset, New York
Reaction Motors, Inc, Denville, NJ
Kentucky Metal Products, 3106 Preston St, Louisville 13, Ky

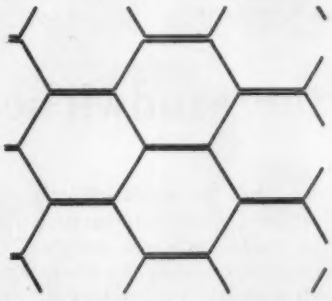
Ceramic, molded—Continental Can Co, 100 East 42nd St, New York 17, NY

A Comparison of Honeycomb Materials

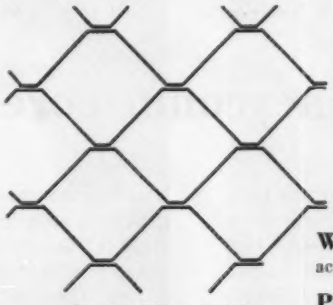
	Total Production (Rating)		Applications		Finished	Materials
	Volume	$ Value	Aircraft	Other	Cost/Cu Ft*	$/Cu Ft
Paper	1	4	25%	75%	$ 30	0.25-5.0
Duck	5	5	(almost abandoned)		Unk	20-40
Glass Fiber	3	2	95%	5%	Unk	25-75
Aluminum	2	1	85%	15%	$100	4-20
Stainless Steel, Brazed	4	3	100%	—	$4000-$8000	400-500

For comparison, various foams cost $4-$60/cu ft, edge-grain balsa (as used in Britain's *Mosquito* during WW II) $10-$50. Materials costs are from Hexcel Products; other figures from our own survey. *Costs per sq ft of panel would be more accurate, if a standard thickness and skin could be accepted. Paper honeycomb is $1 to $10 per sq ft, depending on surface or skin materials; average or typical cost is $3. Aluminum panels cost $3 to $50 per sq ft; average about $10. Stainless steel panels cost from $100 to $3000 per sq ft, but average is unknown because of variations in panel complexity. Even some wood panels may have 50 specially located inserts (bulkheads); some for architectural use may have skins of rare woods costing $2 per sq ft alone.

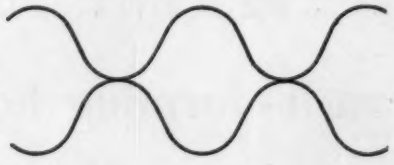
Some typical Honeycomb configurations



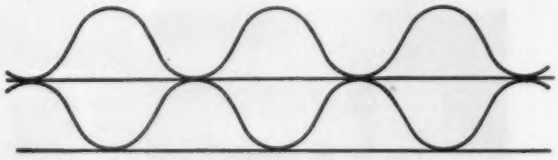
Hexagonal Cell — Paper, Duck, Metals



Square Cell — Metals

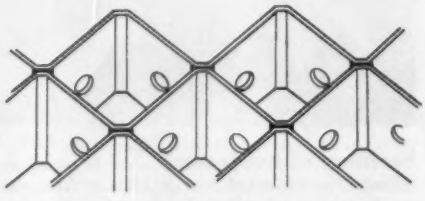


Sine Wave Cell — Metals



Multi-wave Cell — For great lateral strength

Marcel — Really a corrugation



Square Cell with Holes — For fluid transmission

Wax honeycomb, bee-made, is hex, 0.20 in. across flats, with 0.002-in. ribbon.

Paper honeycomb, Douglas-made, is hex, in three cell sizes (across flats), 0.330, 0.440, and 0.455, the first two of paper 0.005 to 0.006 in. thick, the third of paper 0.011 to 0.012 in. thick. Density is 2.0-2.4, 1.5-1.8, and 3.4-4.0 lb/cu ft, respectively.

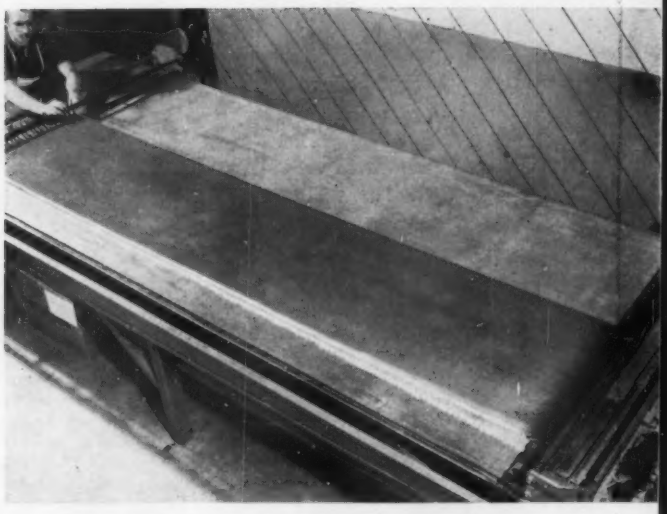
Aluminum honeycomb, Hexcel-made, is hex, has cells ⅛, 3/16, ¼, ⅜ or ¾ in. across flats, with nodes (bond lines) of 0.072, 0.108, 0.144, 0.218, or 0.435 respectively. Bonded stainless is similar. Martin (for Marbond) shows ribbon thicknesses of 0.007, 0.001, 0.015, and 0.02 in. for ⅛-in. cell, with corresponding densities of 3.1, 4.5, 6.1, and 8.1 lb/cu ft. For ⅜-in. cell, ribbon thicknesses are 0.001, 0.002, 0.003, 0.004, or 0.005 in., and corresponding densities 1.6, 3.0, 4.2, 5.4, or 6.5 lb/cu ft.

Square cell Core, in stainless by Hexcel, for example, is ⅛, 3/16, ¼, or ⅜ in. across flats. Nodes are unequal, top and bottom. The smaller node is always 0.035 in. wide, the larger is 0.035, 0.045, 0.050, or 0.060 in. wide, depending on cell size. Such core may be bonded, brazed, or spot-welded—in the latter case with single, line, or area spots.

Sine cell, multi-wave and marcel, as well as hex and square have been made in standard and special sizes, in a variety of high-temperature materials

North American Aviation

Aluminum honeycomb is supplied . . . in compressed solid blocks or billets, expanded blocks, or prefabricated standard-size panels, with hex cell diameters ⅛, 3/16 or ¼ in. and foil thickness from 0.001 to 0.004 in. A typical billet may be 18 in. long, 39 in. wide, and 1½ to 4½ in. thick. It may be machined to thickness and even to form, then is placed on the bed of an expanding table (left). Pins enter cells along both edges to grip it, then the head expands the honeycomb to proper cell shape or desired density (right). A 39 x 2.5-in. billet may expand to 28 x 96 in., for example



Crush - forming honeycomb core for sandwiches

Particularly with aluminum honeycomb, it has been necessary to arrive at formed shapes. These vary from one roughly like half a "corncob" to cylinders (missile fuselage) and elaborate compound curves in airfoil sections, and techniques vary likewise from relatively simple to complex ones.

One problem is to taper the edge of a piece of honeycomb without changing its density. This means, in effect, that it must be crushed or upset without destroying its stiffness. Convair-Fort Worth makes the "corncob" shape now simply by forming pieces of proper outline in a die in a bending brake. Cell walls around the edges are crushed down, but they accordion-pleat rather than buckle or smash, so good stability and cell shape are retained. (Pleated structure is subject to vibrational fatigue unless encased in adhesive.) Such pieces are simply fillers for skin-sheet stiffening bulges, so no great structural strength is required.

Boeing and Northrop have the problem of crushing the edges of a honeycomb section so the resulting structure will be thin enough for attachment at the edges. It is essential that the crushing, both in a tapered area leading down to the edge, and along the edge itself, will be uniform and within the tolerances of ± 0.005 or so required for good bonding.

The current method is to crush the honeycomb in a hydropress, with close-tolerance steel or aluminum dies—simple to describe, but involving months of headache before either company made the process work. The problem wasn't in the crushing, but in the crushing to dimensions accurate enough for bonding, so there wouldn't be voids. Honeycomb provides amazing stiffness and uniform structural rigidity, at lower cost and with less weight than other practical methods—*providing the bond is attained along all cell walls.* Exactness of finished

North American Aviation

Forming of honeycomb . . . is done in this case by rolling. The expanded core is filled with a wax compound to avoid crushing of cell walls, then the piece is placed between protective skins and rolled. Wax is later removed by heating and vibration

contour is the major answer, plus the surgical cleanliness in bonding mentioned later.

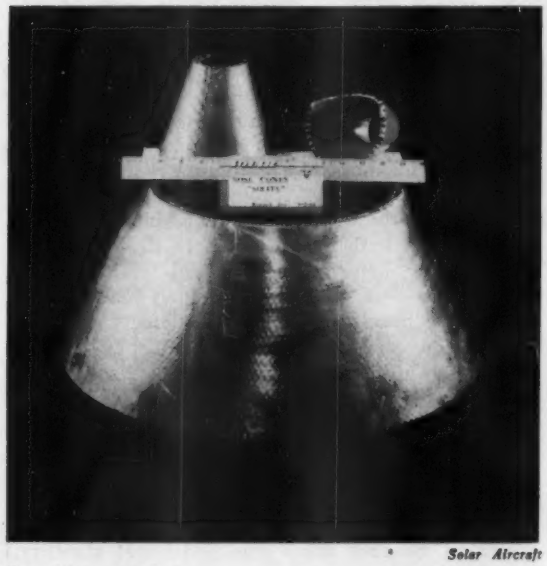
FORMING METAL HONEYCOMB CORE FOR SANDWICHES

Techniques have been developed by practically all fabricators to form metal honeycomb to desired curvatures, either simple or compound. The major requirement is that the honeycomb have a cell structure that permits this, and that the section is not so thick or the curve so small in radius that cell structure is destroyed on the inner face or torn apart at the outer. In some cases, sharp curvatures of thick cross-section have been attained by bending thinner sections to mating shapes, then laminating them together, bonding the layers to opposite faces of thin aluminum foil.

Simple (mono-directional) forming can be done rather easily, the common technique being to use a bending brake with roll sections for upper dies and twin rollers for the lower, so the effect is that of a sheet-forming roll on a more static basis. Roll-forming is also done. In each case, large curvatures are attained by making a series of bends, each greater than the preceding one. Rohr Aircraft has formed simple contours in brazed stainless by stretch-forming.

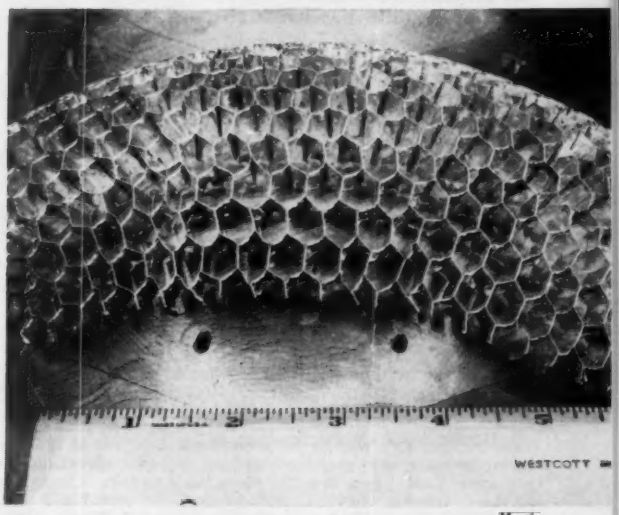
Detailed data on forming can be obtained from The Martin Company report 40.11-108 on compound-curvature in bonded honeycomb construction. A good general discussion of honeycomb is "Honeycomb Sandwich, Cold and Hot," Lecture No. 3, ASM Los Angeles, by G D Cremer, Solar Aircraft Company.

Lack of ductility in the metal, and lack of plasticity in the cured adhesive, make it difficult to form the material by physical strain. Thus the degree of



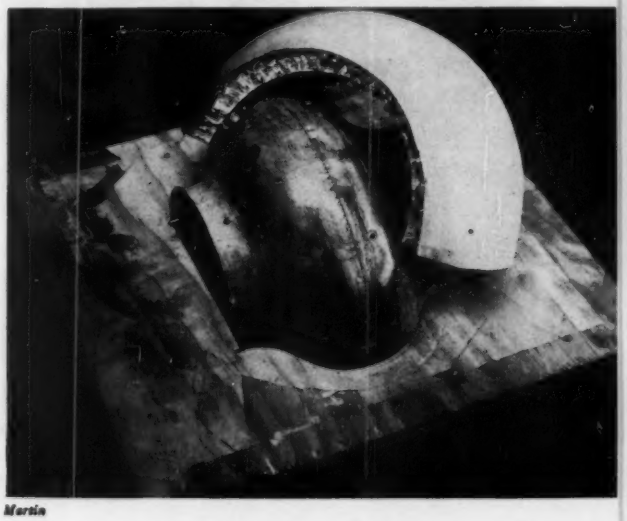
Solar Aircraft

Fuselage sections, . . . nose cones, and inlet ducting are typical all-metal, high-temperature sandwich structure. These are of Type 321 stainless. The large elliptical part has 0.004-in. facings, weighs 0.9 lb/sq ft, can be operated at 1200 F



Martin

Some distortion of cell shape . . . occurs in compound forming, but this aluminum honeycomb came out quite well. It is shown in another picture in a finished sandwich



Martin

Severe double-curvature . . . contouring can be done with aluminum sandwich, as evidenced by this test piece. Here 6061 0.020-in. aluminum skins were contoured on a Yoder hammer, heat-treated to ST, anodized, and adhesive coated. Honeycomb was formed and coated, then parts were assembled on the mandrel, enclosed in a rubber bag and bonded at 310 F and atmospheric pressure in a batch oven

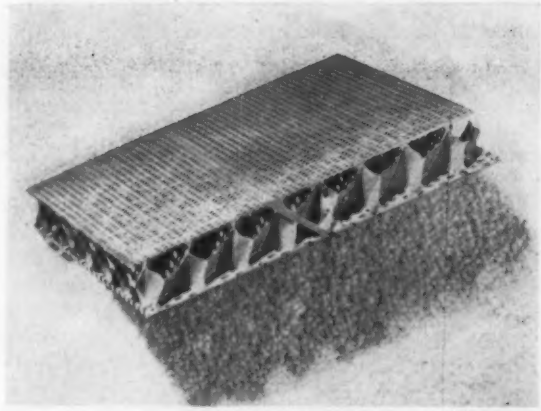
forming is limited to that attainable by cell distortion—and varies with cell shape and size. In compound-curvature forming, this is a particular problem. In the Martin tests, it was found that the combination of a concave arc with a larger convex one was relatively easy to achieve because of the anticlastic (when bent in simple curvature, the core reacts by assuming a saddle contour) property of the straight-cell core material. Surfaces with convex arcs in both directions were very difficult to form.* Actually, both hand "shearing" action — pushing the inner surfaces of the cells together to densify the structure—and some breaking down of cell structure were required to attain the more difficult double-convex shapes.

Attainable curvatures vary with core type, of course. For example, satisfactory curvature of a 2 x 5-in. radius was attained with core ½ in. thick and 0.003 x ⅜-in. cells. With 0.002-in. foil, a 1 x 4-in. double-radius bend was attained. With 0.001-in. foil and ⅛-in. cells, excellent forming was attained. In fact, the tests indicated that the 0.001 x ⅛-in. honeycomb could be easily formed to any shape. A special core, produced by crimping (1/16-in. amplitude) 0.002-in. foil and making hex-cell honeycomb of it, also seemed to form with high flexibility.

Stiffening cells with wax, Cerrobend, or other fillers only multiplied problems (plastic foam might be better, but wasn't tried) as did attempts to support all walls or multiply pressure points with pins or rubber mats. It proved a little easier to bend at 45° with the core axis, than to bend in, or normal to, core direction. (In other words, it is easier to bend honeycomb when bend lines parallel the ribbon direction.) This advantage is lost, of course, in spherical forming—the most common problem. There is also a slight advantage in making the sharper of the two curvatures perpendicular to core-bond or ribbon direction. North American Aviation uses three times core thickness as a minimum radius.

Attempts to "lay up" a compound-contoured surface proved unsatisfactory at Martin because of difficulties with fitting and splicing.

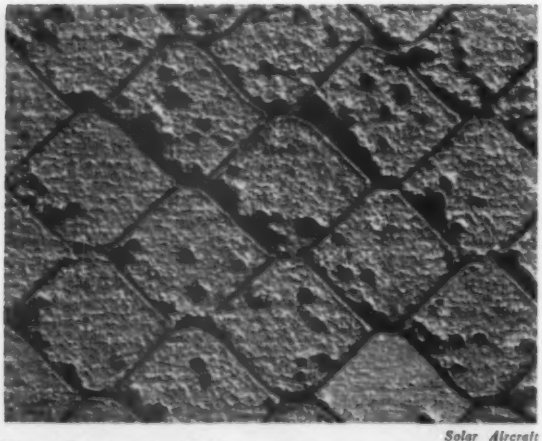
Essentially, honeycomb is chosen for its density, and 0.003 x ⅜-in., 0.002 x ¼-in., and 0.001 x ⅛-in. types have practically the same density (4.2, 4.3, 4.5 lb/cu ft respectively) so the 0.001 x ⅛-in., with practically unlimited formability, can solve most problems. Shear strengths are 240, 250, and 270 psi longitudinally; 110, 115, and 125 psi transversely; and crushing strengths 460, 470, and 490 psi, so in these characteristics they are also comparable. (The 0.002 x ⅛-in. core can take up to 660 psi on ½-in. thickness, over 1000 psi in the composite (finished) condition, because skins give additional stability.)



Solar Aircraft

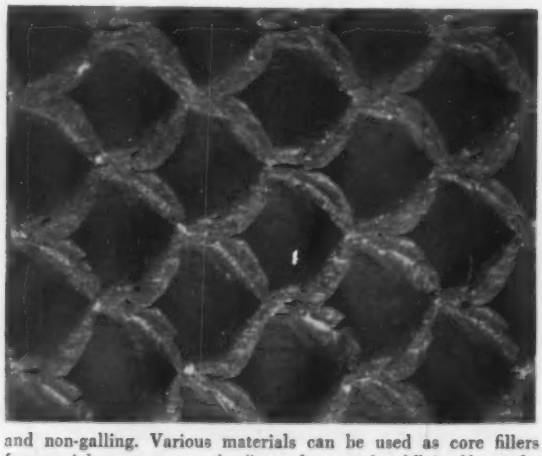
An interesting experimental structure . . . based on novel core geometry. Conventional 0.002-¼-in. cell is set at 45° to the faces of perforated stainless. Special techniques braze faces and core without plugging holes

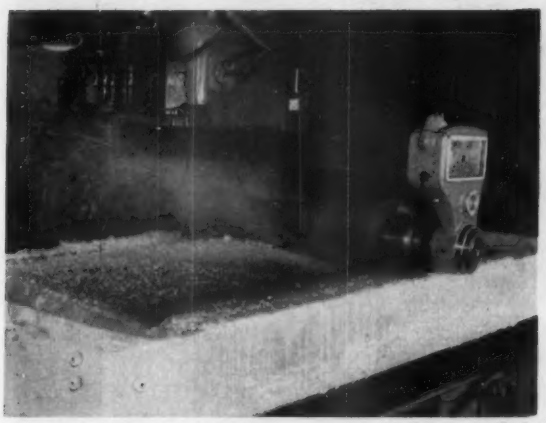
* An inexpensive way to form compound curves is to conform beyond the required radius in one direction to permanent set. Then flex the piece back to take advantage of the synclastic curve. In some cases, the core itself will relax back to desired synclastic curvature. Many compound curvatures can be formed in this way, according to Hexcel Products.



Solar Aircraft

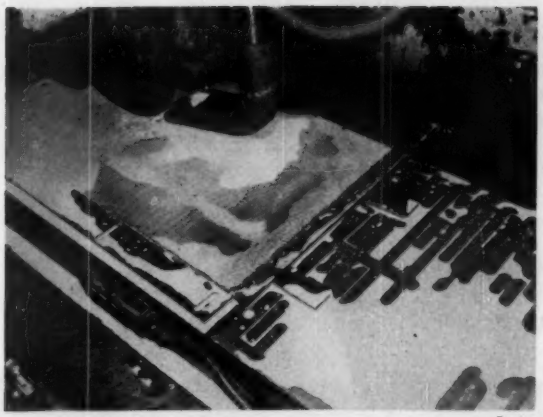
Brazed square-cell honeycomb . . . is here (left) filled with a special sintered metal-ceramic mixture. This provides a relatively smooth wearface that is strong, yet friable and non-galling. Various materials can be used as core fillers for special purposes, or the "open-face sandwich" itself can be used, as for example in a rotor-tip rub ring (right). Cell ends smear over and provide a bearing surface





Boeing

Freezing honeycomb . . . into a block of ice is the commonest holding and stabilizing method. Here is an exceptionally large piece thus stabilized for milling



Boeing

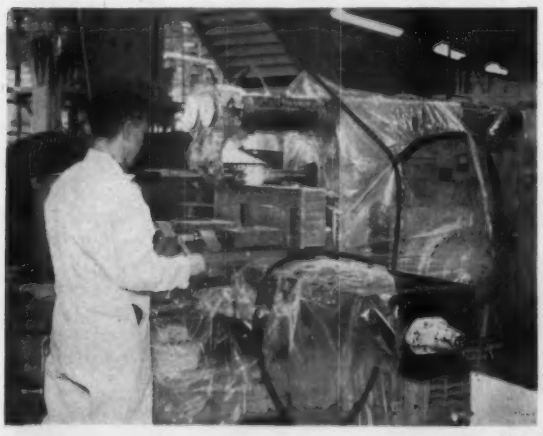
Heat-treated core . . . with 0.002-in. or thicker ribbon can be held on a magnetic chuck for surface grinding. Chuck must be larger than core, so steel blocks at sides and ends can compress core slightly. Polyethlyene glycol is the stabilizer

Stabilizing the structure for machining

Expanded metal honeycomb is obviously a difficult material to hold for machining faces without crushing or burring the cell walls, and the problem is magnified as foil thickness is reduced. Machining method affects both holding and stabilizing, so it is common to use a stabilizer (filler within cells) that is also the holding method.

Commonest of such dual-purpose stabilizers is water. The honeycomb can be set on a refrigerated platen, and water poured over it and frozen, either just to hold the honeycomb down, or to fill the interstices as well. Rohr Aircraft, for example, finds filling unnecessary for straight cuts on stainless core, uses freezing for holding only.

U S Propellers, for example, places expanded core in a tank of water, freezes it, then transfers the block to a contouring lathe so the airfoil shape can be cut with high-speed tungsten-carbide saws. This equipment is in a refrigerated room. A larger duplicating unit of the Keller type is being added, capable of handling work up to 24 x 4 x 12 ft! This is aluminum; Rohr Aircraft produces stainless panels as large as 74.5 x 36.5 in. using the freezing chuck.



Boeing

Resins can also be used . . . as stabilizing materials, as in this milling operation

Much experimenting has also been done with meltable or soluble materials to fill the voids temporarily. Requirements are that the material not affect machining or tools, yet that it be readily removable after machining—without contaminating the core. Among filler materials tried, particularly on stainless honeycomb, are frozen mercury, plaster of Paris, starches, soap, resins, candy, wax, and foam. Convair uses water glass or Carbowax (a water-soluble adhesive). Boeing and North American Aviation hold heavy-foil heat-treated stainless comb (down to 0.002-in. ribbon) for grinding on a magnetic chuck, as long as the chuck is bigger than the core, so edges of the latter can be firmly held. But for 0.001-in. ribbon, a stiffener or stabilizer such as polyethylene glycol (E9000), Epon 1001 or dry glue (40N498), a starch-resin compound, is used. The platen is steel, ground to 0.002-in. face-to-face parallelism and 0.001-in. TIR surface flatness. Platen, core and adhesive are put in an oven and held at 300 F for an hour. The platen is withdrawn first, and the adhesive poured 1/16 in. thick over it (to edge dams ⅛ or ¼ in. thick). The core is placed, covered with a rubber sheet ¼ in. thick, with 30 to 40 Duro hardness, then with a piece of ¾-in. plywood and lead weights. Two hours are required to cool in air.

Boeing has used Epon 1001, Dry Glue 40N498, polyethylene glycol E9000, and ice on aluminum honeycomb, but found that each of these offers less resistance to a cutter than the thinnest of steel foil. The steel honeycomb tends to split and lay over if

How to make sandwich . . .

given a chance. However, both aluminum and steel honeycomb are being machined without stabilization with disk cutters, but not with conventional milling cutters. The 17-7 PH is three times as rigid as aluminum, so can be cut with a disk or a grinding wheel without stabilization in the heat-treated condition. The disk will cut annealed 17-7 PH if stabilized.

AVOIDING STABILIZATION

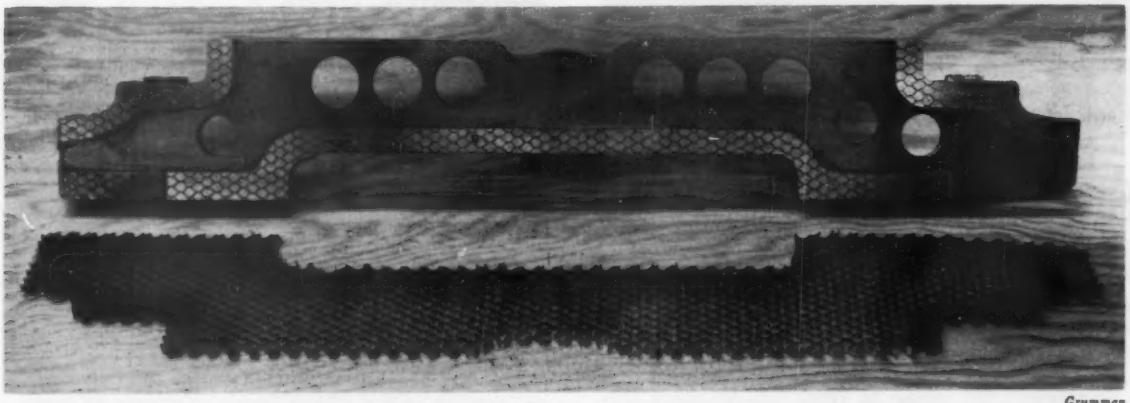
In some cases, stabilizing is avoided by machining the aluminum honeycomb in the billet condition, then expanding it (See sketches of parts). Flat sections are particularly easy to work this way, because they can be sawed and finished by almost any desired method. North American Aviation, and since then other makers, have machined tapers and simple curves on billets as well, calculating the effect of expansion in advance.

To avoid both stabilization and burring problems, several companies have tried Elox electrical-discharge and Anocut machining. Thus far, however, the first method has been costly in electrodes and slow in metal-removal rates. It is essentially an all-electric method; the other is electrical deplating combined with grinding with a diamond wheel. In the latter case, wheels are burrs or rotary files, making end cuts as in end milling. Deep cuts can be made rapidly without burrs. North American Aviation reports development work on this method, using both grinding-wheel and spinning-electrode shapes. The part is the anode in the circuit, electrolytic fluid covers the contact area, and high current at low voltage removes the material, with possibly some scrubbing action by the wheel. Boeing reports the method (Anocut) better for 17-7 PH than for aluminum, because aluminum core requires a tapered edge.

Electrical-discharge methods have, incidentally, been used with considerable success to make holes in finished sandwich. Electrode wear is considerable, but irregular cutouts can be made and holes "drilled" that would otherwise be impractical. In one case, a thousand 0.020-in.-dia holes are drilled simultaneously in an 0.008-in. steel skin in 3 min!

Boeing

Unstabilized cutting . . . can be done with the disk cutter (bologna slicer), particularly on stainless



Grumman

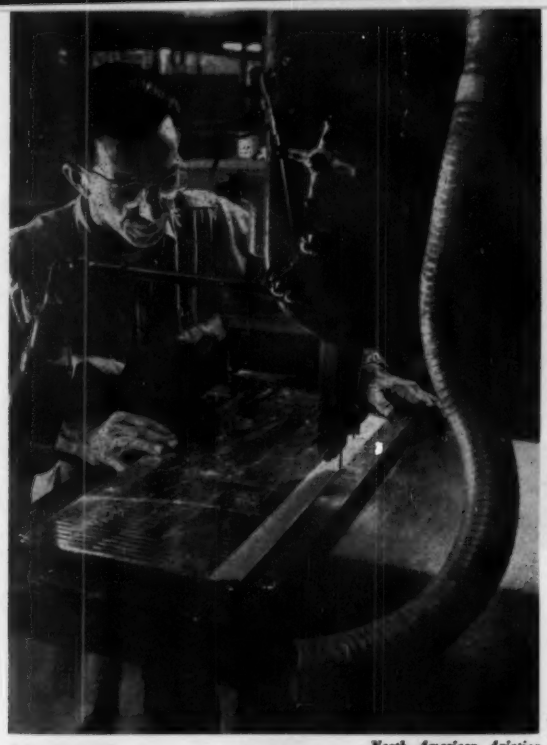
Pylon construction . . . in the F11F-1 calls for panels of aluminum ¼ x 0.003-in. core 0.232 in. deep over-all, sandwiched between aluminum skins of varying thickness. Each panel has four steps at doublers: 0.102, 0.083, 0.051, and 0.032 in. deep, and of irregular shape in a continuous pattern about ⅝ in. wide by 24 in. long. This can be done only by electrical-discharge machining. Electrodes are of ½-in. steel with brass strips machined to plan and bonded on with Epon VI, then steps are machined in. Epon is not electrically conductive, so brass pins and clips are added. Core is held to a platen by double-faced pressure-sensitive tape, with electrical contact (+) established by a lead with alligator clip. Work is immersed in the dielectric for cutting. Depth of cut is controlled by a preset miniature switch on the vertical servo drive. Time for the four cuts (made at once) is about 45 sec to ± 0.005-in. tolerance for depth. Electrodes wear at a rate of 1:20, so brass must be resurfaced after 4 to 6 pieces, depending on depth of cut. Pictured is the electrode (showing erosion), and finished honeycomb. Stepped areas in honeycomb are dyed for clarity. Holes in the electrode are to lighten it

Electrical-discharge and electrolytic . . . methods may be combined for faster cutting. Here honeycomb on an ice platen is being machined under an oil dielectric fluid with a diamond wheel and electric discharge working together

Convair—Fort Worth

North American Aviation

Templet and sharp knife . . . provide a convenient method of marking honeycomb core for cutting. The scored line is outlined with masking tape to guide in bandsawing



North American Aviation

Core may be sawed . . . either in the billet (shown) or after expansion

Machining

Machining processes on honeycomb core for bonded sandwiches thus far have been largely bandsawing, milling, routing, and grinding (both wheel and abrasive-belt). Paper, Fiberglas and duck cores are made in the expanded condition, and can be bandsawed and sliced with ease. In the compressed condition, a metal-core material, properly held, is essentially a solid so can be held with relative ease. But when expanded, some one of the holding (and often stabilizing) methods is required.

Commonest holding method is by freezing to a platen. This is done in many ways, but the common-

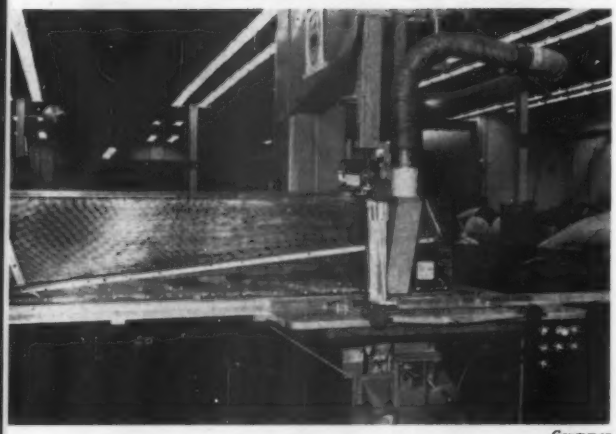
Boeing

A conventional vertical bandsaw . . . set on a tilted base and with table adjusted to the horizontal, does 30° taper cutting

Contour sawing of large areas . . . of core can be done on special horizontal bandsaws. Bandwheel heads are guided by separate templets if contour requires it. In this case, various pieces of honeycomb have been assembled in a fixture as they will be bonded later

North American Aviation

How to make sandwich . . .



Grumman

Special feeding and control equipment . . . on a Do-All 36S bandsaw produces a machine capable of sawing core to contour. A ¾-14 wave-set blade, with no set on the finish side, runs at 6000 fpm. Work is held by epoxy adhesives to platens which are carried through the 36-in. throat (42-in. max clearance) on a drive chain. Contours are achieved by special fixture design so the work can move laterally under cam control. Micrometer adjustment makes possible tolerances of ± 0.010 in.

Grumman

Feed for the bandsaw . . . is provided by a continuous chain passing over a sprocket on a vari-drive motor (0-60 ipm). Guides can be set to handle a straight cut (as shown) or with-

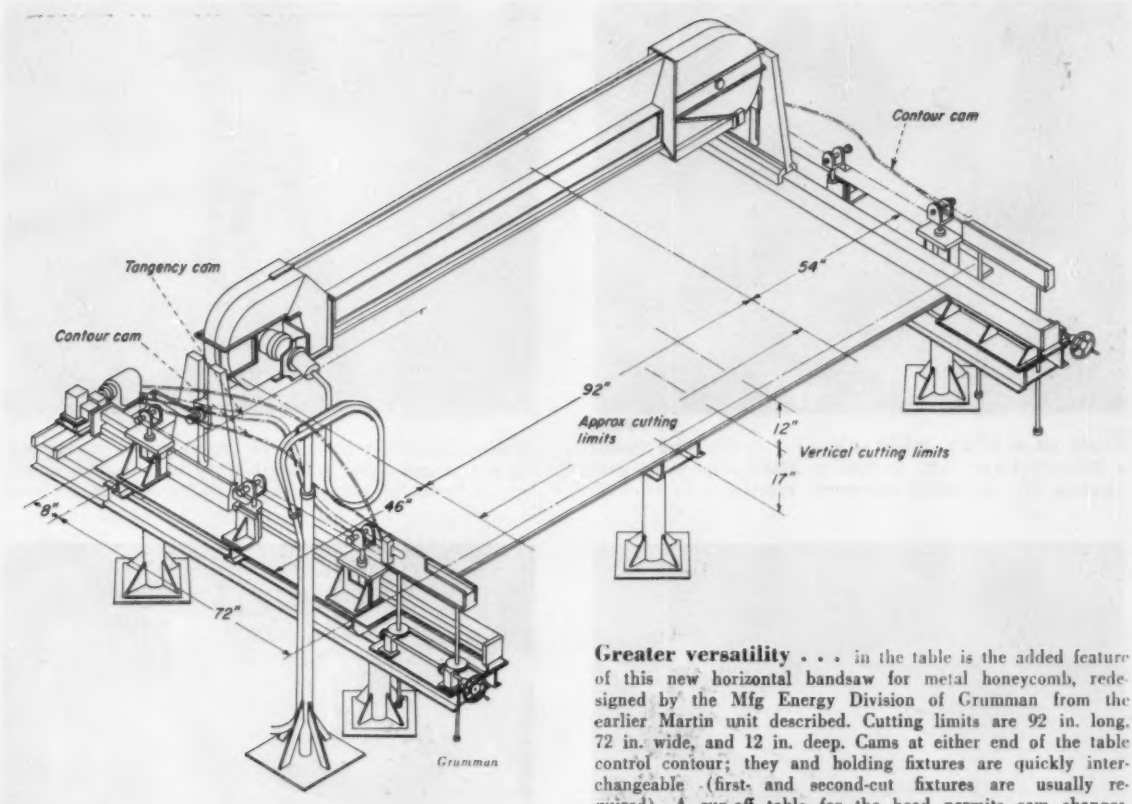
drawn to permit contour sawing. Spring-loaded pressure rollers hold platen against guide or templet. An exhaust duct at the saw line sucks chips upward

est one now is to circulate refrigerant from a portable refrigerating unit through the platen. (Capacities of such units are usually high enough so freezing occurs quickly. Some incorporate reverse cycles so hot water, Freon 20 or 12, can be circulated through the same coils for quick melting and consequent release of the part.) The method does, however, require careful allowance for the roughly 10% expansion of water when it freezes, particularly on large pieces. Platen or box design must control this. The core will come back to original shape without trouble.

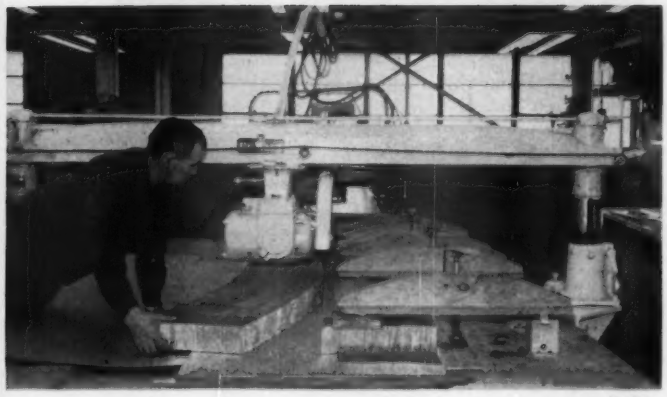
SAWING

Several companies have special horizontal bandsaws with contour-following arrangements to arrive at tapers or curved surfaces. Some of these are separately illustrated.

Martin reported, in Research Report 19.011-50, tests that can be called typical of experiments by



Greater versatility . . . in the table is the added feature of this new horizontal bandsaw for metal honeycomb, redesigned by the Mfg Energy Division of Grumman from the earlier Martin unit described. Cutting limits are 92 in. long, 72 in. wide, and 12 in. deep. Cams at either end of the table control contour; they and holding fixtures are quickly interchangeable (first- and second-cut fixtures are usually required). A run-off table for the head permits cam changes. The head may be tilted 45° either way from the vertical for such parts as wing leading edges and angled 15° either way horizontally. Head feed speed (0 to 12 ipm) at each end is independently controlled through two ¾-hp variable-speed motors with reducers. A Vickers 20-hp hydraulic motor drives the bandwheel at speeds from 6000 to 14,000 sfpm, controlled at the pump, which in turn is driven by a 25-hp motor. All controls are centralized in a remote console. A full wave-set blade, ½-in. x 32p, is used at 600-lb tension



Boeing

Circular saws and abrasive disks . . . on gantries and on jib arms give good finishes in cutting core. This DeWalt table saw with abrasive disk can handle blocks over 6 x 15 ft if necessary

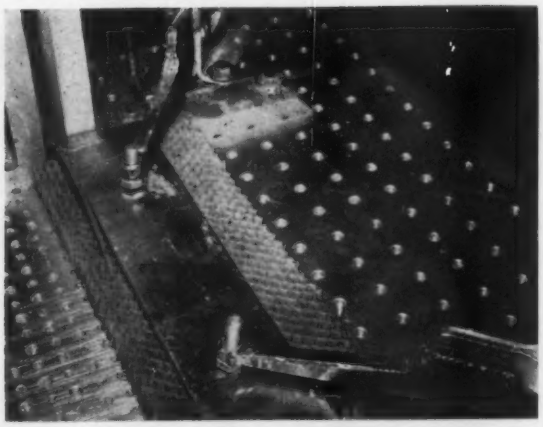
other companies as well. The first was on a unique hacksaw, in which the blade was mounted in a universal swing-type fixture, and the blade reciprocated while the fixture swept the face of the comb. This was, in effect, like a multiple-tooth shaper rather than a saw. It worked, but time was lost on the back stroke, and tolerance was ± 1/64 in.—too great. It was obvious that bigger honeycomb would require longer blades and multiply the errors, so the idea was abandoned.

Martin also attempted a special circular saw, in which twin saw heads mounted at right angles were traversed in a carriage and guided by a cam endplate. Helical gearing drove the two saws, so they cut out an L-shaped piece. This was fast and reasonably accurate, but it did leave a series of small flats on the curved surface, and tolerances were not accurate enough.

Routing and sanding were also tried, but the eventual setup was a bandsaw. Martin's was air-

Boeing

Tests on a 12-in. table saw . . . at 3500 rpm showed a 200-tooth blade (left) at 8000 to 10,000 sfpm made good roughing cuts on stainless honeycomb, annealed or heat-treated.



Abrasive disks 10 or 12 in. in dia (right) caused extreme tearing and jagged edges, bad burring and like troubles, particularly on annealed core. A 20-in. disk cured these problems.

Boeing

Stainless core . . . (heat-treated) of 0.001-in. foil, semi-stabilized with polyethylene glycol, can be surface ground. Either plunge or traverse grinding produces acceptable parts, but traverse is preferred. Max downfeed for roughing is 0.002 to 0.004 in., for finishing 0.0005 to 0.001 in. Table speed can be high—in this case the max is 90 fpm. The 24 x 6-in. DA46-G6-V11 Carborundum wheel required dressing after removing 9 cu in. and before finishing, or burrs were formed. Flood coating is required, so holding work on a magnetic chuck is advisable

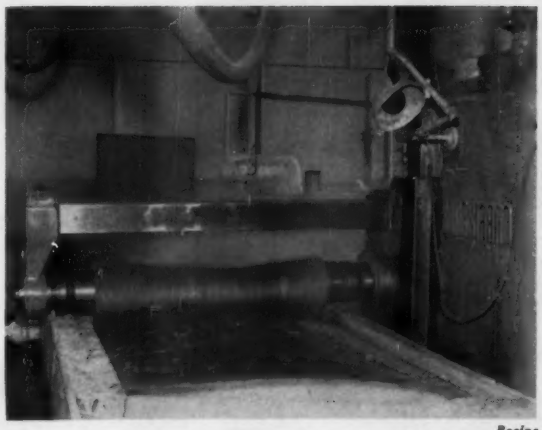
Convair—Fort Worth

A slice of Fiberglas . . . honeycomb core is "machine sanded" (belt ground)—one of the newer techniques

driven, with the saw guided by cams at the edges, and the whole sawing unit on a cam-guided carriage to attain the desired curve. End cams usually differed, to give necessary conical taper to the piece. Feed was automatic, through gearing, and opposite ends were independently fed, again to obtain conical taper. First cut was within ⅜ in., to relieve tensions in comb manufacture, the second to ± 0.010-in. tolerance. Second cuts were smooth enough so no sanding was required, and production rate was good. A safety brake was added, to stop the bandwheels within a second in case of band breakage, but there have been no breaks on production runs thus far. Present blades are 1/32 x ⅝ in., cutting a 1/16-in. kerf. Teeth are 14 pitch, raker set. Blade tension is 700 to 800 lb by tensiometer, and speed is 7200 fpm. Splices in the blade must be square and no thicker than the blade. There is no blade vertical adjustment, so size is attained by proper fixture design. The second face is cut with the piece in a different fixture.

A special holding fixture is bolted to the saw table. It incorporates hinged plates at each end, which can be folded down to clear the blade, but brought up for checking the cut piece with a straightedge across the plates, and feeler gages. Thus, each part to be sawed requires a special holding fixture with check plates, profile or cam end plates, cam follower or tangency plate, and feed gears to produce the correct ratio of end-to-end movement of the frame.

A Tannewitz vertical machine at Convair-Fort



Boeing

Ruddevator cores . . . for the KC-135 *Stratotanker* are milled to shape. The slab is frozen into a box, then cut with a helical carbide-tipped cutter worth $7000. Curve on the core is uniform from end to end, and the cutter is about 10 in. in dia by 30 in. long

Boeing

Edge trimming . . . to plan can be done by vertical milling the stabilized core

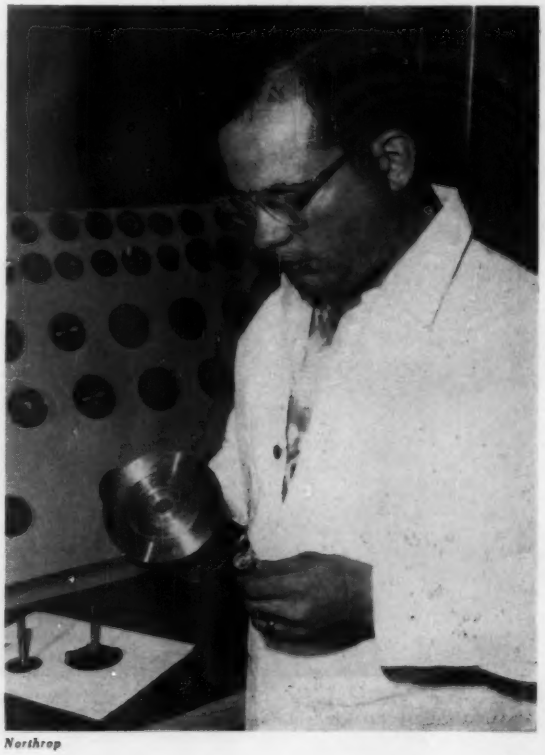
Worth has an inclined table to ease feeding of the unexpanded slab or billet, is "tuned up" to avoid vibration, has special blade-welding to avoid misalignment or thickness difference, carefully set tension, a vacuum face to hold the billet tightly—and still requires a very skilled operator. But it can cut billet to within ± 0.006 in.

Conventional vertical bandsaws are the common method of rough-cutting expanded core to the desired plan. Here tolerances are not so close, because the core can be stretched or compressed slightly to fit. Normal practice is to cut a little large and compress the core into the space. This eases the problem of edge bonding, by whatever method, and the change in core density is so slight it is unimportant.

Friction bandsawing, with single- or double-beveled knife blades, proved better than conventional sawing with 24-tooth blades, when Boeing tested both on stainless honeycomb. A DoAll Zephyr saw was run dry at 11,000 fpm for friction sawing and 1600 fpm for conventional tests. Hand feed of 5 fpm, guided by templet, gave an acceptable surface with a single-bevel knife blade. Conventional blades tore the material; the friction blades did not.* However, best edge finish was obtained from an abrasive disk, mounted on an overarm saw. The blade in this case was 20 in. in diameter by ⅛ in. thick, running at 1800 rpm in a DeWalt table saw. Core ⅝ in. thick, of heat-treated 17-7 PH, was cut at 2.5-fpm feed; but at 4 fpm, the core collapsed and a burr was formed.

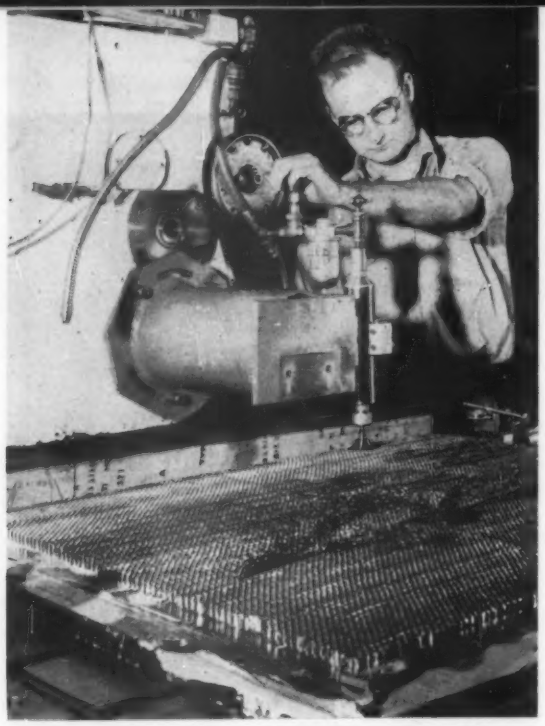
For some structures, the sawed contour — to ± 0.006 to 0.010 in.—is accurate enough; for others, tolerances must be within ± 0.002 in. In such cases, the saw is used only to rough out the billet, and one of the other methods, usually the "valve-stem" or "bologna slicer," does the finishing. At Convair-

* Toothed blades give good tolerance but poor surface; plain blades produce good surface but poor tolerance.

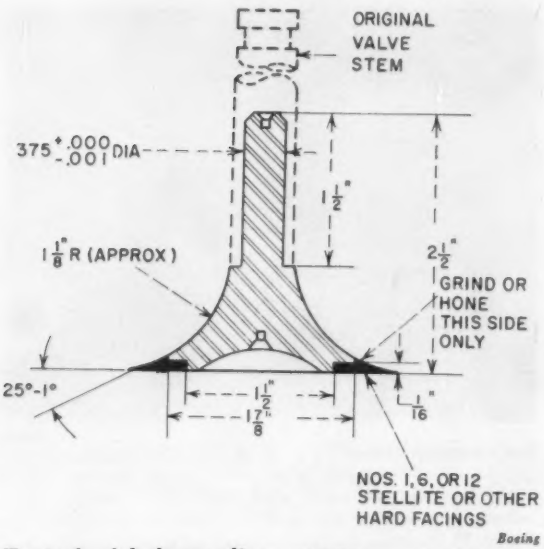


Northrop

Disk, valve-stem, or "boloney-slicer" cutters . . . are common for machining honeycomb core. Here are typical ones, varying from ¾ to 6 in. in dia. Cutter at left on bench has three V-shaped serrations, the one next to it has two chip-breakers; both are designed for very deep cuts. These cutters have 1 to 2° concave bottom clearance, 10 to 30° top clearance, run at 10,250 to 35,000 rpm, depending on size



How to make sandwich . . .



Boeing

Typical of bologna-slicer setups . . . is this one on a boring mill, using a high-speed head and hard-edged cutter (insert) on stainless core

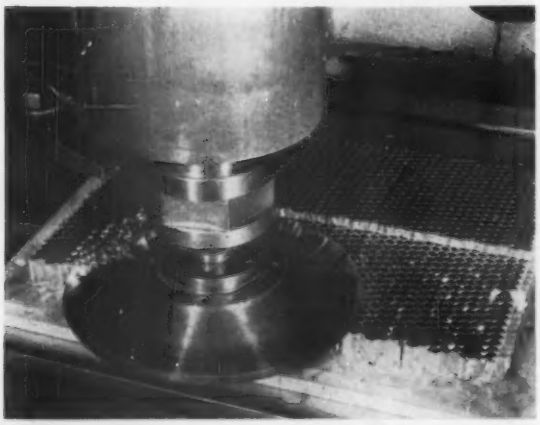
Fort Worth, the sawed piece is inspected on a "miking table"—surface plate with a dial indicator on a carriage over it. The dial indicator has a shoe that bridges one core space.

GRINDING AND "SANDING"

Rough-cut honeycomb at Convair is "sanded," with water as a cutting fluid, to ± 0.003-in. tolerance. Originally, grinding wheels were used, but sanding has proved preferable. The machine, made by Engelberg-Huller Co, Inc, Syracuse, for grinding stainless-steel honeycomb, is unusual. It will hold thickness within 0.0015 in. Surface is 100% burn-free and there is reportedly no "layover" (burr) on edges of cells, even on material only 0.001 in. thick. But the method will not work on aluminum. A 4-head machine, with two roughers and two finishers, is used. Alternate belts rotate in opposite directions and work is carried under them by an abrasive-belt conveyor. The grit of the conveyor must be varied according to the cell size of the work, but no hold-down or other tooling is required. Roughing belts are 220-grit silicon carbide, wet. Finishing belts are made of cork impregnated with 24- to 30-grit pumice and do not change dimension. Work can be made parallel or taper.

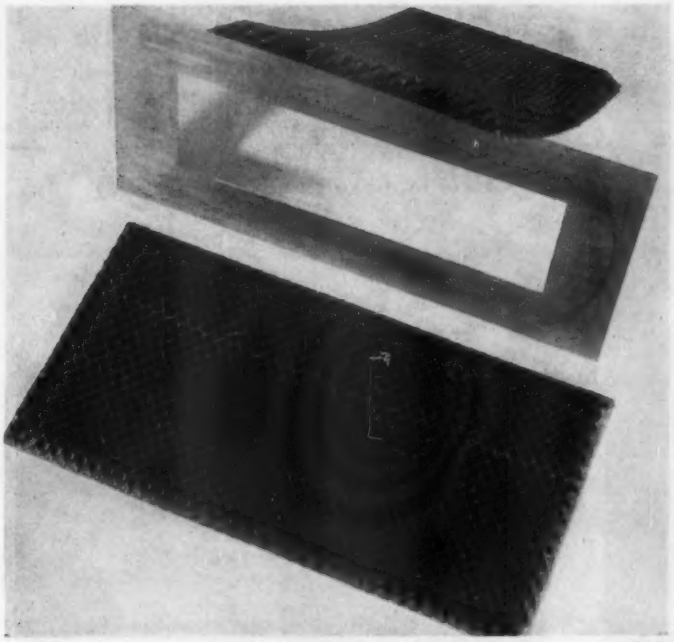
SURFACE GRINDING TESTS

Surface-grinding tests at Boeing on heat-treated stainless core were done at 0.005-in. depth of cut, 0.060-in. crossfeed, and 34 fpm table speed. Beyond these limits, edges were torn, chipped, or cracked. Annealed honeycomb laid over every time grinding was attempted. Tests were with 10-in. Bay State



Boeing

Indicative of cutter size and finish . . . on aluminum are these examples, that at left with a 6-in. cutter, that at right with a 2-in.



Boeing

Tests were run . . . on a ⅝ x 18 x 35-in. panel of annealed 17-7 PH stainless (to be formed to 60-in. radius for titanium skins) held down with 40N498 dry glue and machined with a Stellite-edged cutter at 18,000 rpm. Roughing cuts were 0.010 to 0.050 in. deep at 7½-ipm table speed. Finishing cuts were 0.030 in. deep, with the cutter honed every other pass. The step was cut at bevel, then the air head tilted to 90° and the step cut machined. Then the panel was turned over on a special plate and the step cut machined. Finishes were suitable for bonding

9A46-H12V2 and a Carborundum DA46J9V20 wheels on an Abrasive 3B grinder at 2150 rpm (5650 sfpm), and soluble oil as a coolant.

Cup-wheel grinding was tried with an 18,000-rpm air motor. Acceptable finishes were produced with a Norton 37C46 wheel at 0.010 and 0.030 in. depth of cut in a 2-in. width at 1½ to 10 ipm feed on heat-treated material. Higher feed or cut caused breakaway or chipping of ground surfaces. Annealed core could not be finish-ground because of layover.

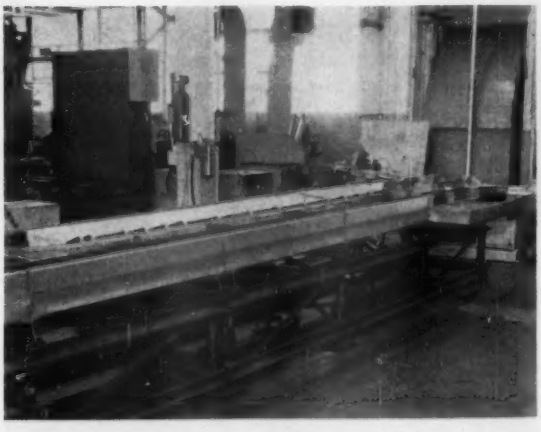
MILLING

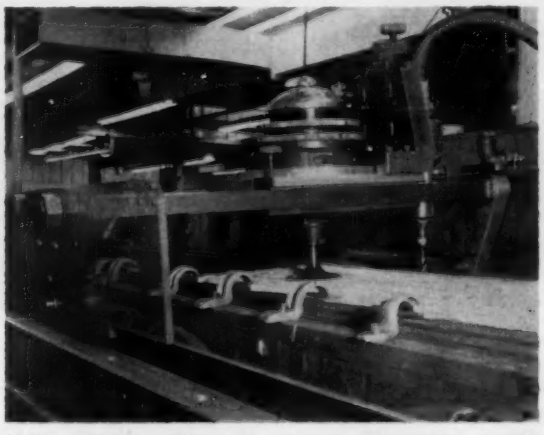
Slab-milling of honeycomb core for bonded sandwiches to shape is done by several companies. Boeing at Renton, for example, makes the ruddevator for the KC-135 *Stratotanker* this way. Several companies are currently studying duplicator milling for complex shapes. Rohr developed a hole saw for stainless core capable of drilling holes ½ in. in dia and up to as much as 40 in. long!

Stabilization by filling with water and freezing—or filling with some other material—is practically essential in milling. Some notching and shaping are also done by milling with this method. Actually the process is just like regular milling, except that the material cut is the stabilizer and the core material, and allowances must be made for the mixture. If ice is the filler, care must be taken to avoid generation of heat that would melt it and allow burring.

SLICING

Perhaps most interesting and unusual of core-machining processes is that of "slicing." Cutters are





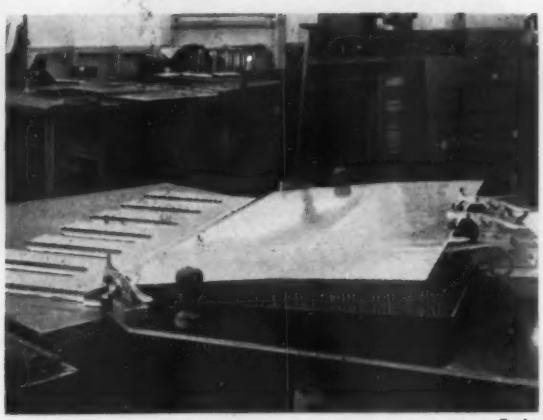
Boeing

Long sections can be tapered . . . on this special bed, over which a disk cutter passes on a carriage (inset). Also on the carriage is a milling head for edging

How to make sandwich . . .

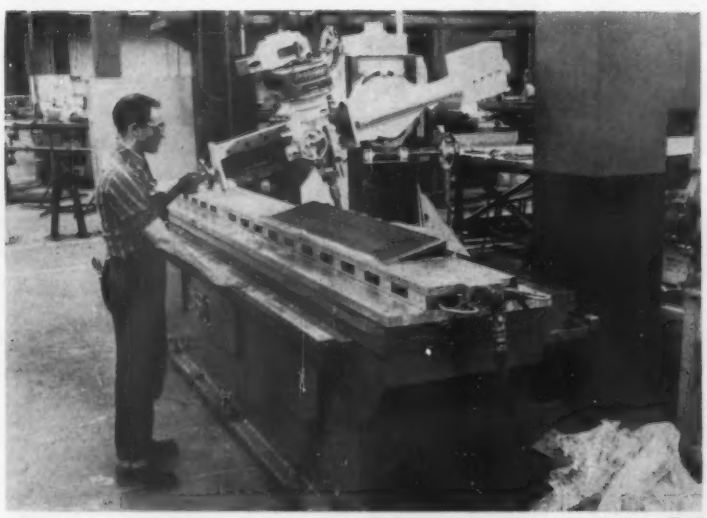
North American Aviation

Aluminum honeycomb . . . filled with wax can be routed by hand with conventional equipment. Here clearance steps are being cut to a scribed line



Boeing

Routing of finished parts . . . may involve special fixtures. Here fingers of a spoiler are being trimmed



Convair—Fort Worth

Multiple passes . . . on an inclined plane over a great length, without riser-plate fixtures, are possible on this special tapered-core router or miller. A traveling carriage supports an overarm above an Onsrud base. The arm can be adjusted to cut an inclined plane as great as 20° off the horizontal and carries a 1-hp Bridgeport milling head (Model J) over an 18-in.-wide by 141-in.-long piece. The head is adjustable to cut up to 45° chamfer along the base. Spindle speeds are 80 to 2720, carriage feeds 10 to 40 ipm

disks like those used for cutting cloth or slicing cold meat, and with the shank look like large engine valves, hence the names "bologna slicer" and "valve-stem cutter."

A wide variety of cutters have been developed for various purposes. Boeing has some, for example, about 3 in. in diameter with feather edges of Stellite or other hard facing. They are ground nearly flat

on the open face, with a 1⅛-in. radius on the shank side, blending into an edge angle of 25° ± 1°. Rohr stuck with the slicer on stainless when it was generally discarded, improved it for this use, now has slicers from ½ to 10 in. in dia. They cut burr-free at a uniform 7500 sfpm. Rohr technicians use a chipbreaker with the knife when slotting or grooving is done.

Plain disk cutters are suitable for aluminum core, but show relatively short life on stainless. Boeing's tests showed a 3:1 life for the hard-faced 2¼-in.-dia cutter. Feeds are usually around 10 ipm, and life runs 140 to 180 linear in. for the hard-faced cutter, dropping off with deeper cuts. Plain cutters ran 25 to 60 linear in., but lost 10% average life when foil thickness in the core cut was increased from 0.001 to 0.002 in. Greatest efficiency resulted from a series of cuts 0.015 in. deep, rather than attempting a single cut to depth.

Similar tests with the cutter in an 18,000-rpm air-driven head were run on heat-treated stainless honeycomb foamed with BAC foam 307, Type 1. The abrasive action of the foam made plain cutters useless, but the hard-faced cutter will give about 30-linear-in. life at 7½-ipm feed and 1/16-in. depth of cut (about 1/5 normal for unfoamed areas).

These cutters are used in vertical millers or boring mills equipped with special rise-and-fall cams on table or fixture to attain required contour. Tolerances of ± 0.002 in. can be obtained with a roughing and finishing cut. In some cases, water glass or Carbowax is the adhesive holding core to platen; in others, a refrigerating unit provides cooling (and later heating) for ice making. Northrop has a fixture incorporating refrigerating coils in the platen which is set on a central balljoint. The platen can be tilted to a stop on any of the four sides, and locked there, to attain a particular taper.

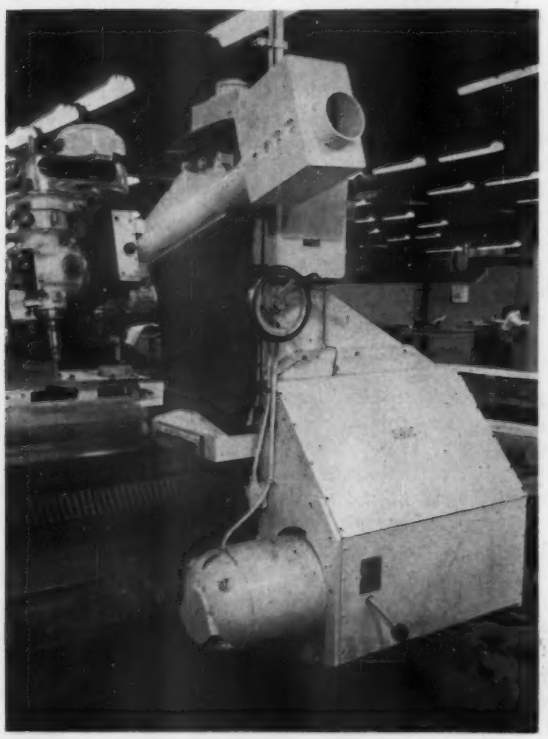
ROUTING

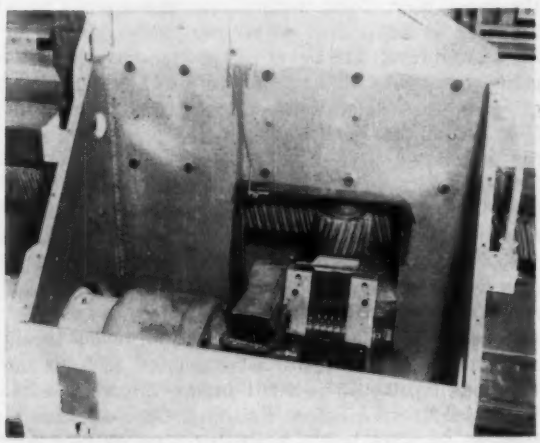
Edges of core sections must usually be cut to a special shape, and it may also be necessary to step them to fit into a supporting rim in the cavity of the structure. This is commonly done by routing, either with a hand router, where tolerances permit, or by more exact machines, such as the two from Convair-Fort Worth illustrated.

SPECIAL CUTS

Tests on special panels made by Boeing are indicative of approaching problems and their solution:

Friction-disk cutter and grinding wheel were used together on heat-treated stainless of two different densities. The panel was ⅝ x 18 x 32 in., of which a 4½-in. edge strip was 3/16-in. cell and 0.002-in. foil (3-20), spotwelded to 3/16-in., 0.001-in. foil (3-10). Tools were driven by tiltable air motor. Steps were like those described in an accom-





Carriage drive and details . . . of support are clearer in these pictures, the second with the carriage-drive box opened, showing the 1½-hp Lima Gearshift Drive and the gearing

Convair—Fort Worth

Standard pin router, . . . with special plate or bed, cuts steps on aluminum and Fiberglas core. The cutter extends up through the bed to cut on the underside of the core. Holes around the cutter create a vacuum to hold the core down tight. (Masking tape covering the top of the core holds the vacuum.) Cutter depth is set by the dial gage below the table. Pieces are fed by hand, guided by straight or adjustable templets. No platens or fillers are needed, cuts are within 0.003-in. tolerance, cutters are quickly interchangeable

panying caption, except that the bevel was made on the second side only. Rough cuts were at 13.5 ipm and 0.010 to 0.125 deep, finish was 0.030 in. deep at 7.5 ipm. In this case the step slice was cut first, then the 0.040-in. doubler cut—requiring two 90° shifts of the air motor. The second side was cut with the core on a special stepped plate, and the step cut the same way. Then the job was transferred to a Mattison grinder with wheel periphery dressed to the desired level. The bevel was plunge-cut with progressive downfeed of 0.002 to 0.004 in. Finish-grinding was done with a downfeed of 0.005 to 0.001 in. at the same angle. Finish was acceptable for bonding.

Grinding technique was used on a 17-7 PH, ½ x 6 x 11-in. stainless panel to have a stepped doubler area all around one side 2 in. wide and 0.040 in. deep, with a 45° bevel all around the other. The core was set up on a magnetic sine plate after faces were finish-ground. It was put on an Abrasive 3B surface grinder, with wheel speed of 6000 sfpm, bed travel 34 fpm. Downfeed was 0.002 to 0.004 in. for roughing, 0.0005 to 0.001 in. for finishing, with the wheel dressed before finishing. Core cells were filled to varying levels with dry glue 40N498 for stabilization; this aided greatly in grinding the feather edge on the bevel. Grinding produced an acceptable finish on all surfaces except where the dry glue did not fill cells. When a cut other than perpendicular to the base is made, support of cell side walls is lacking, so a stabilizing agent appears advisable.

GENERAL

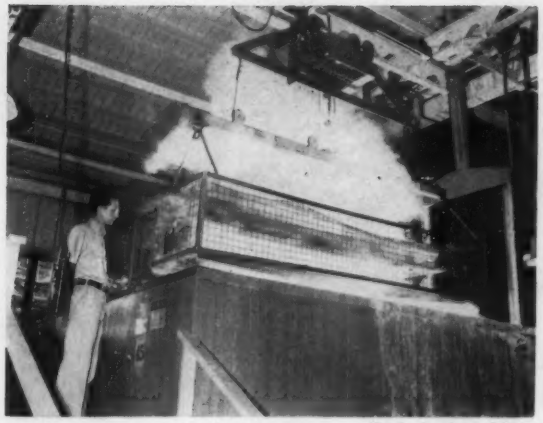
Machining methods are still in the development stage, so many changes can be expected. (After all, some fitting of tapers and diagonals is still done by hand with a bread knife.) Changes are, in fact, going on continually, and methods described here may be superceded before this report is published. Descriptions here do, however, indicate the general methods in wide use, and the problems thus far solved in machining what is essentially a "flabby" or accordion structure.

AFTER MACHINING

After finish-machining and careful inspection for size, shape, condition of cut surfaces, and the like, the honeycomb is washed thoroughly and clinging chips, etc, blown out with air. This is still a slow hand operation, but no better method has thus far been found for performing this important step. At this point, aluminum honeycomb (or other adhesive-bonded types) may be given a "close cure" —heating to polymerization temperature to make sure all bonds are cured.

At this time, too, assembly splices may be made. This step varies from simply interlocking separate pieces to careful bonding of core elements into one piece, depending upon the job. It is possible, also, to combine several different "densities" of honeycomb for various sections, if greater density is required in a particular area.

Other operations — additional inspections, tests, bending, forming, preheating Fiberglas to set it into a desired shape, etc—are done at this time, before final cleaning and preparation for the exacting assembly operations. At this time, also, prefitting of the core into the machined or chemical-milled cavity may be done. No description of preparation of the "skeleton" will be given here, because it follows conventional practice.



North American Aviation

Cleaning cut honeycomb . . .
is an exacting job, involving several steps to be sure all grease is removed

North American Aviation

Cleaned and assembled honeycomb . . .
is primed before assembly in the skins

North American Aviation

The cleaned outer skin . . .
is laid down in a fixture, covered with a piece of cheesecloth impregnated with adhesive (Epon here), and the cut and contoured honeycomb core laid over it

North American Aviation

Assembled core and outer skin . . .
are wrapped to a vacuum table and put into an autoclave for bonding. Then the opposite skin is put in place and the process repeated

Assembly

BONDING WITH ADHESIVES

During the past decade, epoxy-base organic adhesives have been used increasingly in aircraft, first for metal-to-metal joints of flat sheet, and more recently for joining honeycomb to skin. As a matter of fact, without some adhesive or similar bonding of most of the surface area of honeycomb to skin and other structural parts, honeycomb structure would be of little value.

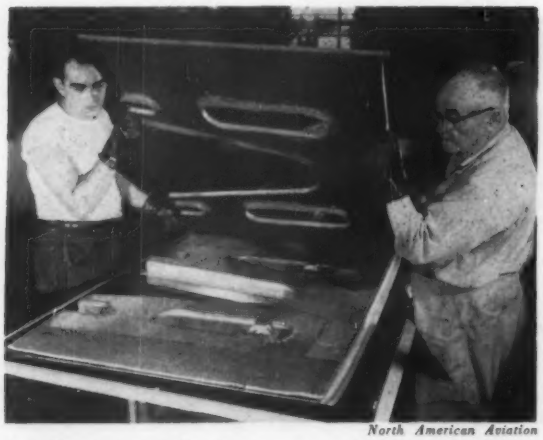
Bonding gained its initial acceptance because it did away with the multiple costly steps in applying conventional fasteners. It provided the essential aerodynamically smooth surfaces for supersonic planes, avoided local stress concentrations around the conventional fastener, permitted thinner skins and consequent weight reduction, made more-complex designs practical, and so on. It increased resistance to fatigue, damping effect, and reduced corrosion. Best of all, it made it possible to combine the liquid-sealing of joints with the joining.

For example, the B-36 has over a fourth of the exterior surface of the wing bonded to stiffeners with an organic adhesive (neoprene-phenolic-nylon). The *Matador* B-61 has 80% of the wing and tail, plus some internal structure, bonded; 425 bolts are avoided in joining the two halves of the wing, for example. Cost is cut a third, time 75%.

Adhesives (see Table) are undergoing intensive research because so much is required of them. They must be strong, resilient, adherent, resistant to moisture and fuels, thermally stable, and have long "shelf life." They must go through a semi-fluid state during curing so joints are smooth and fillets are formed. There must be "no-pressure" forms for some applications. And it is desirable that the useful temperature range be as wide as possible.

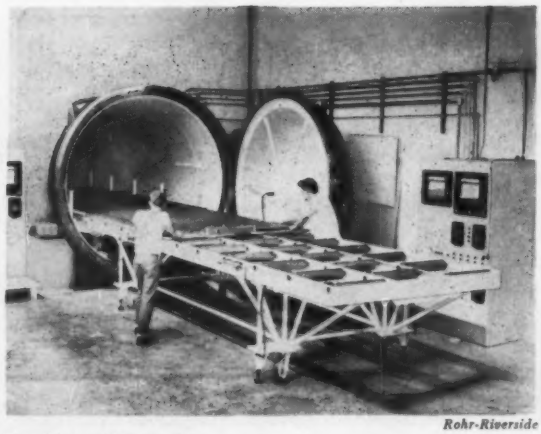
Basically, adhesive bonding is the application of

How to make sandwich . . .



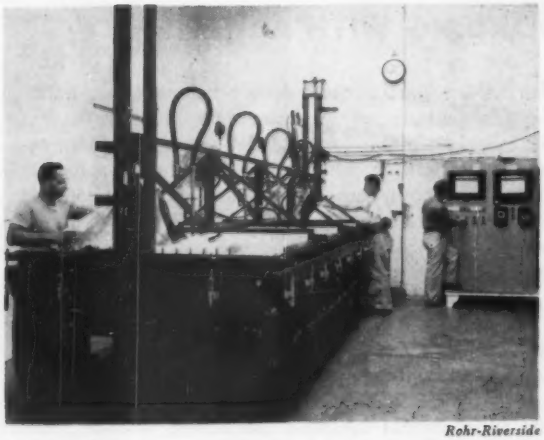
North American Aviation

An alternate method . . .
of preparation is to coat both honeycomb and skin with adhesive, then to assemble



Rohr-Riverside

Horizontal autoclave . . .
8 x 22 ft, cures bonded structure. Structures are in nesting jigs on large transfer sheets, are rolled in from wheeled transfer dollies. Max operating pressure is 250 psi. Al to Al, Al to Mg, and Mg to Mg have been bonded



Rohr-Riverside

Large platen . . .
with vacuum bag, bonds some honeycomb sandwiches under atmospheric pressure. Platen temperature is closely controlled during heating and cooling

North American Aviation

Assemblies may be bonded . . .
in an autoclave of the clamshell type. Here the assembly is being placed on a foil-covered base. It will be covered by the pressure pad at left

controlled heat and pressure so the adhesive will set. Heat is most commonly provided by steam coils or pipes, but an increasing amount is provided electrically. Pressure is provided most commonly by air bags pressing on exposed portions of the assembly. Lead or iron weights may also be used, but do not assure as uniform pressure over the entire surface as does enclosure in a vinyl bag or metal diaphragm that can be exhausted while the assembly is in an autoclave or similar low-pressure, low-temperature device. Bonding pressures seldom run as high as 150 psi, and temperatures are seldom above 350 to 400 F. However, aircraft parts to be bonded are frequently so big that equipment becomes similarly outsized. Several companies, including Northrop, have presses (with rubber bags for platens) that are at least 6 x 18 ft in working area. They also have autoclaves like clamshells that are as much as 8

Typical Adhesives for Bonding

Adhesive	Source
422 J (36-in. wide)*	Shell Development Co, Emeryville, Calif
4021 Metlbond**	Narmco, Inc, Costa Mesa, Calif
620 Plastilock**	Goodrich Tire & Rubber Co, Akron, Ohio
FM-47 Marbond	Bloomingdale Rubber Co, Chester, Pa.
Aerobond 422*	Adhesives Engineering, San Carlos, Calif
302 Metlbond	Narmco (see above)
TTG-500**	Honeycomb Structures Co, Inc, 5510 W 102nd St, Los Angeles, Calif
Bondmaster 611	Rubber & Asbestos Corp, Matawan, N J
M 24	Rubber & Asbestos Corp, (see above)
M 602	Rubber & Asbestos Corp, (see above)

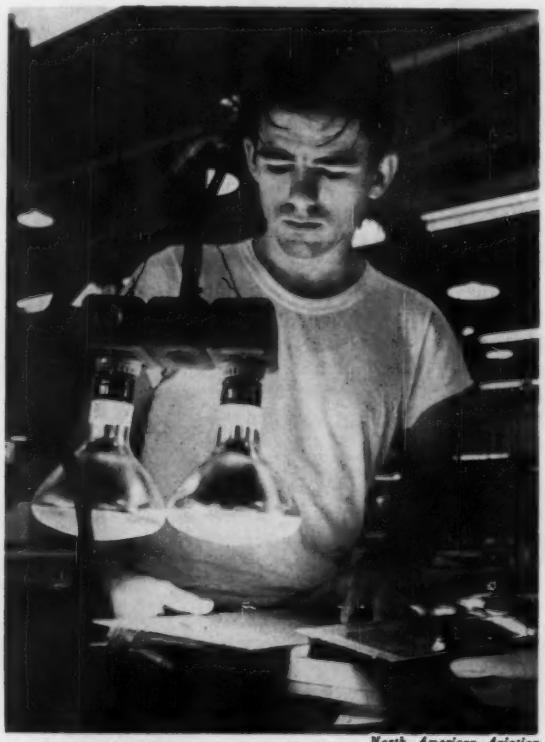
* good up to 450 F ** good to 260 F

Douglas

Multi-deck sandwich . . .
forms the keel section for the LCVP-36 landing craft. It is Fiberglas-reinforced polyester Aircomb. This is an example of multiple-layer honeycomb laid up wet with epoxy resin and set cold

North American Aviation

Final preparation . . .
for bonding is being completed in the foreground, while the other autoclaves are "cooking" assemblies



North American Aviation

Curing of small parts . . .
can also be done directly under heat lamps. Here a trailing-edge assembly with Epon is so handled

ft in diameter. For some really big assemblies, horizontal cylindrical autoclaves are used. Boeing has a new one at Seattle that is 9 ft in diameter and 27 ft long. It contains three racks or platens, because assemblies are usually large in only two dimensions. With such a unit, one set of platens can be loaded while another is "cooking," and the platens interchanged on cars.

Douglas has recently developed a unit for paper bonding that looks like a pants presser, with a flexible metal diaphragm to transmit pressure, while hot oil circulates to the mold plate. North American Aviation has steam-heated "pants pressers" for trailing-edge parts. Molten salts have been tried successfully as a heat-transfer medium, as have form-fitting electric blankets, the latter in a clamshell-type bonding press developed by Martin for the *Matador* wing. This utilizes air bags for pressure.

How to make sandwich . . .

Basically, adhesive bonding must be preceded by proper cleaning and surface preparation. Parts may be fitted beforehand but, once cleaned, may not be touched by hands, for even this slight coating may cause failure of the bond. To insure cleanliness, most companies require operators to wear cotton or rubber gloves, and work is done in a restricted area. One company calls its separate room a "hospital area" to indicate the surgical cleanliness required.

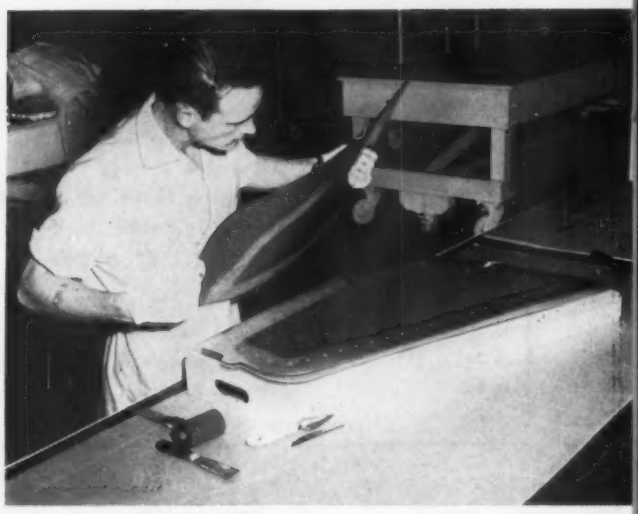
CLEANING BEFORE BONDING

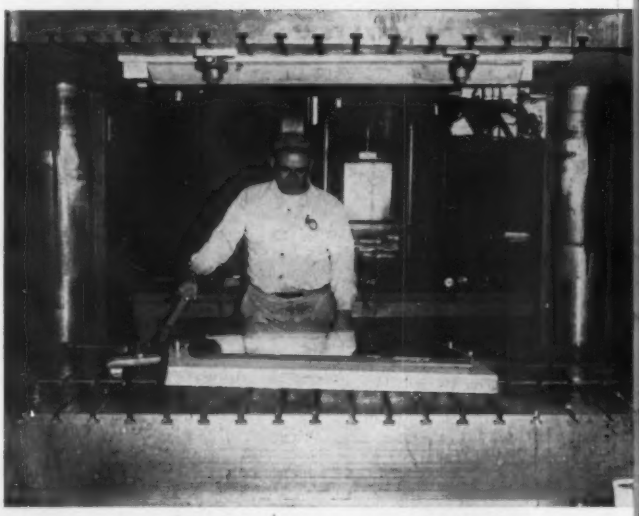
Cleaning procedure varies with the materials, of course, and is essentially the same as that accorded the same metals in conventional practice, but is much more strict in degree of cleanliness required. Aluminum is cleaned by dipping in an alkaline cleaner or by vapor degreasing (North American), rinsing in water, and checking for water break (an unwetted area, indicating the presence of grease, etc). This is followed by a chromic-sulfuric acid bath, water rinse, and oven-drying. Special anodic treatments may be added. (Where used, aluminum castings are degreased in a trichlorethylene-vapor bath, then sandblasted.) Wood and phenolic parts are cleaned by light sandblasting or sand-papering. For magnesium, the process is essentially similar, except that the steps are (1) degrease, (2) Dow process, (3) bake dry.

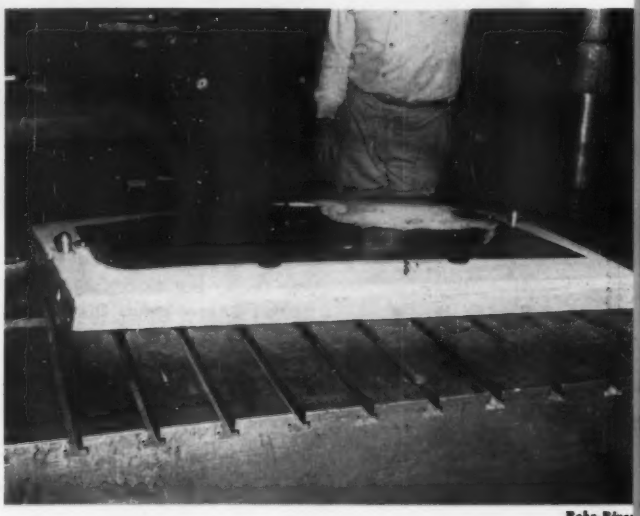
After such cleaning, the parts are never touched by bare hand—in fact, aren't even breathed upon if it can be avoided. Most handling is by hooks or carriers of suitable materials. Bonding quality depends upon fit, pressure, and cleaning, but the vital one of the three is cleaning.

SPLICING

Need for larger honeycomb-sandwich assemblies, and the effort to conserve relatively costly core material, has resulted in development of techniques for splicing. Splicing also permits densification of core in a particular area, or a change in ribbon direction. In effect, the edges of the two sections are brought together and cells along the joining line for ¼-in. width filled with adhesive. North American Aviation reports the cost of splicing as $0.65/splice plus $0.03/sq in. of splice area. Strength is excellent. Weight is increased in this area, of course, but the wide belt of adhesive compensates for mismatched core-block cutting lines. Studies are now being made on methods of reducing glue-line thickness.

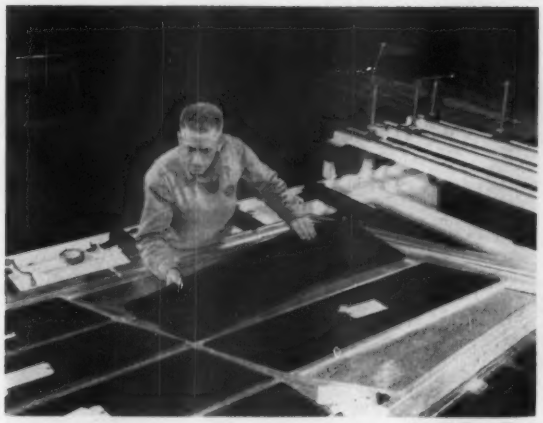






Shapeup of bonded honeycomb panel . . .
with edges crushed in hydraulic press utilizes an epoxy tool. Sequence shows layup (top), setup for pressing, and pressed panel (bottom)

Rohr-Rive



Convair-Fort Worth

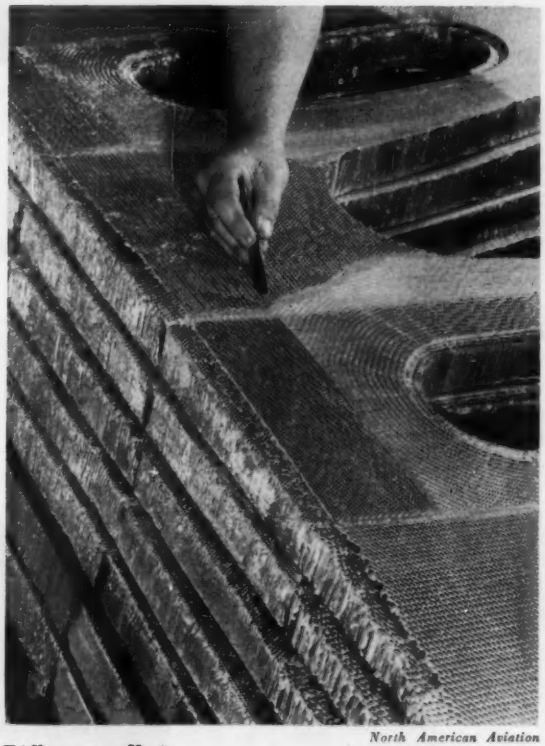
Core is prefit . . .
to the "slug" (integrally stiffened skin panel) and labeled for location in this first of three pictures of assembly of Fiberglas core

Convair-Fort Worth

Prefit slices of honeycomb . . .
are installed in the panel. Film adhesive bonds core to panel

Convair-Fort Worth

Liquid adhesive is applied . . .
with a brush to areas of a panel where the slug is to be bonded



North American Aviation

Different cell sizes . . .
and/or foil thicknesses, may be assembled in one core for strength in local areas. Here is such a spliced assembly for a dive-brake door

North American Aviation

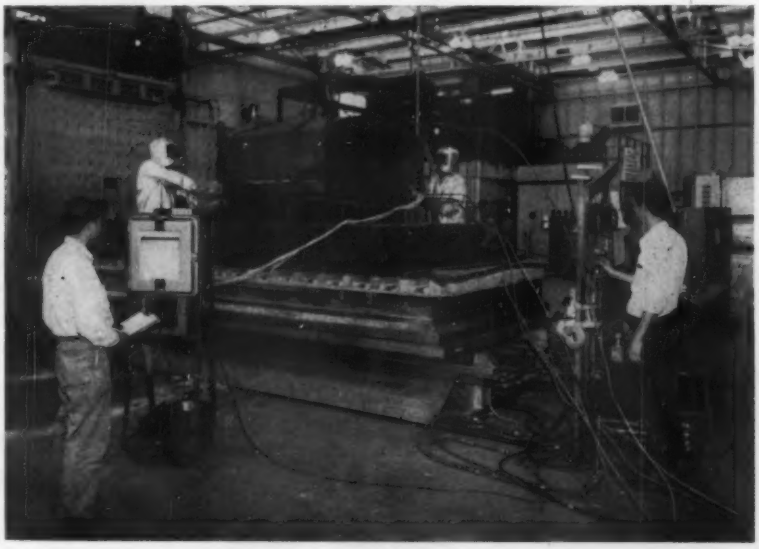
Finished parts are checked . . .
by electronic means. Other inspection methods were described in detail in *AM*—Dec 17 '56

Rohr-Chula Vista

Brazing alloy is tacked . . . (spotwelded) to core in layup of the sandwich by the Rohr-pioneered technique. Skin goes over this, then assembly is placed in furnace. Note gloves, jacket, and "surgical" cleanliness

Brazed assembly is the newest method

As aircraft and missile speeds and loadings increase, we are rapidly moving out of the strength and heat-resistance ranges of conventional materials and structures. Titanium alloys and stainless steels have the necessary resistance to oxidation and aerodynamic and blast heating, but they must be made into air-cell structures to provide necessary strength-weight ratios. Various conformations are being developed, including waffle, expanded-metal, grid, corrugated, and honeycomb designs, all to form the filler in a sandwich structure with outer skins of stainless or titanium alloy. Best and most practical thus

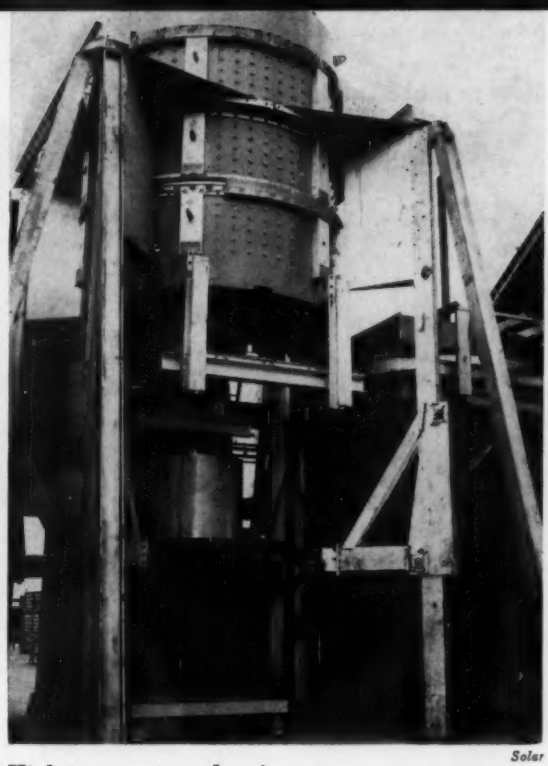


Rohr-Chula Vista

Final preparation for brazing . . . involves sealing the assembly in an airtight box on a heavy supporting base. The base is on a car which rolls into the 7x7x16-ft (working area) furnace at left. Furnace temperature can go to 2500 F max, but 1800 F is the usual operating temperature. Man with clipboard (left) controls temperature, man at gages (right) checks atmospheric controls. Other operators wear aluminized clothing that reflects 95% of radiant heat

Rohr

Dramatic evidence . . .
of the strength of honeycomb structure is this demonstration setup



Solar

High-temperature brazing . . .
of honeycomb structures is done in this Solite elevator-type bell furnace. Largest of its type, it is 8 x 10 ft and rises 35 ft from the floor. Kenthal heating elements provide 300 kw. Fan blades, loading forks and thermocouple tubes are Inconel; support bolts 80 Ni 20 Cr; the grid support and fan shaft 35 Ni 15 Cr; and radiation shields 18 Cr 8 Ni. A spare grid will be Inconel

far is the honeycomb as the sandwich filler, with stainless steel or titanium as the "bread." With brazing or welding as the "butter" to join filler to skin, the sandwich structure is strong and heat-resistant enough to handle all current and projected requirements for a few years.

Typical Brazing Materials

Mo-braze (melts at 3450 F)—American Electro Metal Corp, Yonkers Ave, Yonkers, NY

Durhy (silicon and carbon—for SiC)—Carborundum Co, Niagara Falls, NY

Coast Metals (85% Ni, 2 to 3% Si)—Coast Metals, Inc, Little Ferry, NJ

Silver-Manganese (85% Ag, 15% Mn)—Handy & Harman, 82 Fulton St, NYC

Manganese-Nickel (68% Mn, 32% Ni)—Handy & Harman, 82 Fulton St, NYC

Palladium-Silver (75% Ag, 20% Pd, 5% Mn)—American Platinum Works, Newark, NJ

Solabraze (a family, including H, I, IX1, NX1) (60-85% Ni, to 20% Cr, to 30% Mo, ½ to 5% Si, 0 to 3% Boron)—Solar Aircraft Co, 2200 Pacific Hy, San Diego, Calif

Nicrobraze (4% Si, 16.5% Cr, 4% Fe, 3.8% Boron, 1% C)—Wall Colmonoy Corp, John R S, Detroit 3, Mich

Honeycomb structure is an anisotropic (properties differ with direction) integrated, sheet-metal assembly in which the facings are the prime load-carrying members. Proper design permits ultimate compression strengths to be realized, even with very thin faces, because the core provides continuous support to prevent buckling, yet transmits shear stresses. This is true of adhesive-bonded sandwich, but it can withstand perhaps 450 F, while the brazed type can withstand 1200 F in sustained flight. Facings or skins are usually 0.010 to 0.030 in. thick, core stock 0.001 to 0.010 in. Materials include AISI 321, Armco 17-7 PH, Inconel X, Multimet, and Haynes Alloy 25 (L-605). North American is planning to use AM-350 and Thermold J. Below 900 F, the 17-7 precipitation-hardening stainless seems superior, above that Inconel X or L-605.

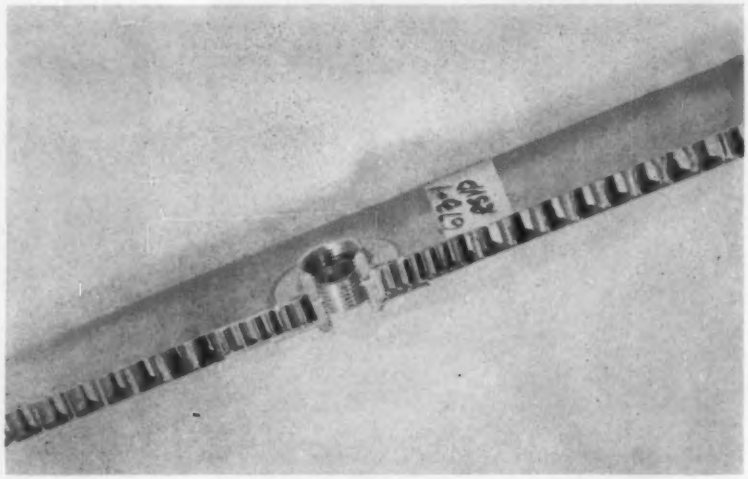
There are many production and experimental honeycomb shapes. Some have been stitched, eyeletted, slotted, or expanded to make core structure, but the commonest methods are adhesive bonding and resistance welding. In the case of adhesive bonding, the brazing material is expected to replace the adhesive when the sandwich is made; the resistance-welded structure is unaffected by brazing. Incidentally, in a brazed structure of ⅛-in.-cell material 1 in. thick, there would be over 1/5 mile of capillary braze fillet per square foot!

Both welding and brazing have been tried in as-

How to make sandwich . . .

Temperature Limitations of Typical Thin Aircraft Skin Metals

6A1-4Va	600-700 F
17-22A	600-700 F
410	800-900 F
17-7 PH	800-900 F
Type 321	1000-1200 F
Type 310	1200-1400 F
Inconel	1500-1700 F
Inconel X	1300-1400 F
L-605	1500-1900 F



Solar

Solid sections or fittings . . . can be brazed into honeycomb. Here a massive boss is in a high-density sandwich casing for a jet-engine compressor

sembly, but welding thus far has proved impractical because of limited current-carrying capacity and compression strength of the honeycomb. Resistance welding is possible, but not yet practical. . . . The Solar Aircraft Company Research Division made an exploratory investigation of resistance-welded honeycomb sandwich several years ago which showed the extreme technical difficulties with this method of joining sandwich. Twenty to fifty per cent of metal-to-metal weld bonding of the thin-walled core to facing was the maximum achieved on laboratory samples. No solution appeared to exist for nondestructive testing the resistance-welded sandwich structure for quality control. Because of lack of fillets at the joint, X-ray inspection methods used for braze joining were not applicable. . . . North American Aviation has experimented with resistance welding to grids etched on facings.

BRAZING METHODS

Metallurgical brazing (temperature high enough so there is some diffusion of braze metal into base metal) is thus the current method of joining. It provides large bond areas, distributing stress uniformly—even strengthening the core itself at joints. Surgically clean parts are a necessity thus far, demanding exceedingly well controlled degreasing and even pickling. (North American Aviation has recently made tests indicating surgical cleanliness may be unnecessary.) Flux, if any, must be a special type to insure corrosion resistance of assembly.

Basic problems are positioning of brazing alloy, flux, and parts in a proper fixture, accurate holding to insure desired shape and yet achieve metal-to-metal contact of faces and core, controlled heating and cooling rates to avoid warpage and stressing, atmospheric protection to avoid oxidation of parts and contamination of joints, control of post heat-treatment to develop desired metallurgical conditions, sizing, coining, or other plastic deformation to strengthen the part by cold work. These are major problems, because it is relatively difficult to repair brazed sandwich panels. It is preferable for them to be right to start with. (Incidentally, battle-damage tests show that well-made honeycomb is surprisingly strong. Damage is local, and skin peeling from projectile penetration halts at the cell-wall joint. Also, experiments and tests during the past few months on battle-damage repair have proved successful in most cases.)

HYDROGEN ATMOSPHERE

Furnace brazing is most practical thus far, but induction brazing shows promise. Convair, Martin, and North American use silver alloys. Solar practice is to braze in hydrogen atmosphere, using alloys that tend to form new alloys with the materials brazed so that the joint is actually able to withstand higher remelt temperatures than those at which it was made. This is possible because the elements (boron, carbon, silicon) which make the alloy melt at 1815 F tend to reduce concentration during brazing or subsequent heat treatment, and remelt temperature goes up to 2550 F.

To provide specific information on the problem, one production method will be described. It is of interest to point out that 17-7 PH stainless core, with ¼-in. cells 1 in. thick, costs about $90 per sq ft ($400 for Inconel X or L-605!) silver-manganese brazing alloy (¼ lb) about $5-$8 and 0.010-in. skins of 17-7 PH about $2. This is about $100 per sq ft for materials alone, but care and careful handling tend to keep this obviously expensive method from being passed up because of excessive costs.

America's first supersonic bomber, . . . the B-58 *Hustler,* is a delta-wing design incorporating hundreds of square feet of brazed honeycomb sandwich structure. Here it is shown in flight carrying an underfuselage detachable pod, which gives it great versatility on missions

How "Hustler" Panels are Brazed

Production procedures for brazed stainless-steel panels have reached an advanced stage of development at Convair-Fort Worth, where the B-58 *Hustler* supersonic bomber is being made—"the first production aircraft to use brazed stainless-steel sandwich panel as primary structure," according to Lt Gen C S Irvine, deputy chief of staff, Material, US Air Force. This bomber, which first flew in November '56, is reported to utilize about 1200 sq ft of stainless panel. Most of this is the 17-7 PH material, high tensile and difficult to fabricate.

Proper tooling, quality and process controls are the essentials in achieving consistently satisfactory panels, and the prime factors in bringing price down to reasonable levels. It thus may be helpful to outline Convair methods, emphasizing control and not dwelling on standard details of cutting or brazing mentioned elsewhere.

Stainless-steel sandwich material is received from the vendor and sent to Receiving Inspection. After routine examination for damage in shipment, proper thickness, and the like, samples from each shipment received are sent to the Process Control Lab. Spectographic examination determines whether the heat or batch falls within the range of chemical analysis allowed in purchase specifications. Response to heat-treatment is checked by actually heat-treating a portion of the sample as it is done "on the line." Tensile tests determine strength properties. Not until the samples have passed all these tests is the incoming shipment released from the impounding tag at the receiving dock and sent to the proper storage area. This is an important initial control—no material ever reaches storage areas unless it is suitable for use.

When a section of core material is taken from the storage areas, it is checked again for thickness, core size, and possible damage. Thickness readings at various specified points are recorded on a "core history sheet;" these readings show how much stock must be removed at these points and any areas where the core is too thin. (By careful selection and location of pattern, many such areas can be salvaged.)

Panel or contoured sections of honeycomb must be cut to ±0.003-in. tolerance, because tolerance between core and skin at the joint must not exceed 0.006 in. This demands extreme care in cutting, special cutting equipment, selective assembly, and assembly tools which serve as checking fixtures as well.

The common adhesive for attaching stainless core to a platen machining is sodium silicate (water glass), although freezing or Carbowax (a water-soluble adhesive) may be used. In setting up a platen, a 2 x 2-in. test block of core of at least the same thickness as the workpiece is set up alongside on the platen. The operator checks machine settings on this block before cutting the actual core—a major factor in reducing spoilage.

At the machining area, the platen is attached to a special bed and held in place by vacuum. A lubricating agent (Ivory soap) is applied to core and test block, and cutting done with a "bologna slicer" or

"valve-skin" type cutter, able to make cuts as thin as 0.020 in. without creating burrs.

When the surface is finished, it is visually inspected for burrs or mashing, removed from the platen, and checked at a dozen or more points of thickness. It is then turned over, reapplied to the platen, and machined on the opposite side. Again thickness is checked at a number of points and a surface inspection made. Inspections total perhaps a dozen during and after machining because of the many possibilities of error, such as lifting of the core over the platen (either by loosening from the adhesive or being bridged by it), uneven expanding, damage in handling and the like.

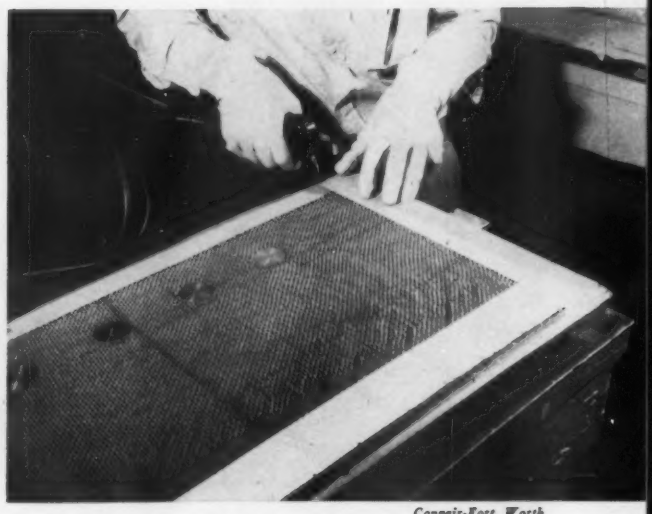
ASSEMBLY

Assembly is one of the most critical areas in brazed-panel manufacture, for here the details are assembled into the panel; once assembled, the panel *must* be brazed—it cannot be disassembled to add or subtract parts, to correct an improper fit or incorrect procedure, or for any other reason. This is the point of no return, so inspection, checking, and control procedures are critical. To avoid initial problems of cleanliness and dust control, the entire operation is carried on in a special room called a "hospital area" because of the surgical procedures followed.

Detail components are prefitted to tolerances of ±0.003 in. in glass-fiber reinforced plastic fixtures with metal-sprayed copper inserts. (Copper disperses heat better, thus avoids burning or puddling in tack brazing.) Fixtures are made to precise dimensions, slightly undersize to allow for the growth in the panel which will occur in brazing and heat-treating.

All details are thoroughly degreased and cleaned, subjected to a mild etch, and thereafter are never handled with the bare hands. Either rubber or cotton gloves are worn by assembly operators, because even a fingerprint can leave enough oil to cause a void or unbrazed area. Cleaned parts are again inspected to be sure they are surgically clean. Also edge members and inner-skin assembly and spot-welds are inspected, and parts are kept in trays to reduce individual handling. Incidentally, one early source of contamination was found to be the salinity of supposedly clean and pure rinse water.

Assembly proceeds in the fixture, with continued checking to avoid overlap of brazing ribbon and damage to parts. Some strips are quite thin (0.002 in.). Details are tacked in position by electrobrazing with special resistance spotwelders. Core, cut slightly oversize to provide intimate contact between it and edge members, is inserted, and strips of brazing alloy positioned and fitted around it. Ends of core ribbons are aligned with edge members, and cell walls or ribbon edges which may have become distorted since machining are corrected. The core is weighted to prevent movement, and a trigger-operated electric tacking gun used to tack ribbon ends to the edge members.



Convair-Fort Worth

Strips of braze materials, . . .
carefully fitted, are tackwelded in place over the core and within the fixture

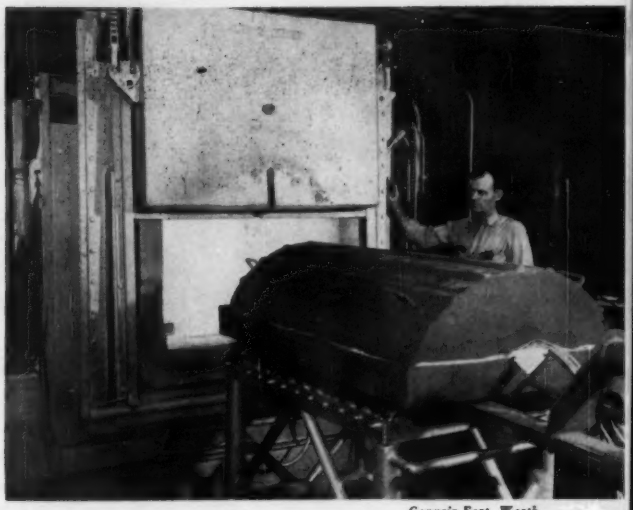
Convair-Fort Worth

The assembled panel . . .
is placed on a graphite block in the braze box. The stainless cover sheet, coated with stop-off, has been rolled back here for the picture. It will be welded in place around the edges

After the core has been tacked around the entire perimeter, the outer skin is set in place and also tacked to prevent movement during any operation prior to brazing. All tack brazes are light so that when the panel reaches brazing temperature, the tacks will break loose and allow details to "grow,"

Convair-Fort Worth

Welded braze box . . .
is connected at right for cycle purging. A vacuum pump first exhausts the box, then inert argon gas is pumped in



Convair-Fort Worth

Braze box is placed in retort, . . .
assembled as described in text, and loaded into a smaller brazing furnace. The assembly will be removed after approximately four hours

and flanges and skin to lie flat. This growth amounts to 0.0045 in. per inch.

After the panel assembly is completely "tacked," it is ready for "canning." The "canning" process consists of the placement of a 1½- to 2-in. graphite block, the top face being either flat or machined to a slight concave configuration to suit the particular panel being run, into a stainless-steel "pan." The "pan" has a 1½-in. flange all around, and the depth of the pan is equal approximately to the thickness of the block, plus the thickness of the panel.

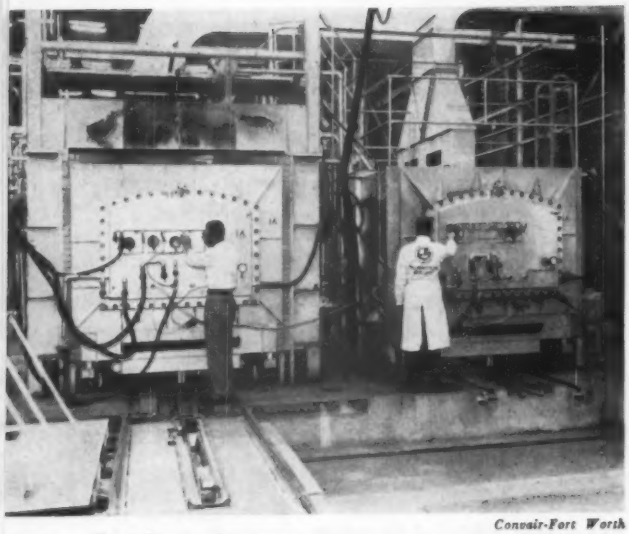
After the block is in the pan, a stainless-steel sheet, 0.008 in. thick, called a lower cover sheet, is placed over the entire face of the graphite block. This keeps the panel free from contamination which might result if in direct contact with the block. A thin coat of "stop-off" (benzated alumina) is painted on this sheet and, when dry, the panel is centered in the panel area using guide lines for accuracy. The panel is now in position with its outer surface next to the block, with the inner face of the wide leg of the "Z" member exposed. On this face, braze forms are set in place, completely surrounding the panel and equal in height to the depth of the zee-angle edge member. These braze forms are also painted completely with "stop-off," as was the lower cover sheet, to prevent the sheet and braze forms from becoming attached to the panel if brazing alloy should exude from the panel during the brazing cycle.

After the braze forms are in place, the filler sheet (same thickness as edge members) is set in place next to the inner skin. We now have an assembly that is of uniform thickness over the entire area of the panel. Over this is placed a sheet of 0.010-in. stainless steel, then a layer of "Fiberfrax," which acts as a pressure pad to keep all members of the panel to remain in "an interference contact" with each other. Over this, an 0.032-in. stainless-steel upper cover sheet is placed, then the vacuum sheet (0.005 in. thick) is placed over the entire assembly which extends over the flanges of the braze box. The vacuum sheet is then clamped to the flange all around and "Heliarc"-welded shut, making a completely airtight container. The container is now checked for leaks and forwarded to the brazing area.

Here, thermocouples are attached to the outer surface or top of the braze box. These thermocouples must be either "zero" or calibrated, as the temperature reached during brazing is very important and thermocouples are the only link between the furnace and the operator. Through this medium he is able to determine when the panel has reached temperature (1815 F). Two to six thermocouples are used, according to the size of the panel. Over the top of the thermocouples, another sheet of Fiberfrax and an 0.032-in. sheet is placed, and the entire assembly is now ready for brazing.

The box is placed in a retort, which is an airtight chamber. The door of the retort is closed up and bolted in place. Through the door, there are tubes to carry the thermocouple wires to the recording device on the control panel. There is an opening for the vacuum tube, which runs from the braze box to the vacuum pump.

The car carrying the retort is placed in the "purge station" and here the vacuum tube is attached to the vacuum manifold and the retort is flooded, through another opening in the door, with argon, an inert gas, necessary and capable of creating an atmosphere around the braze box, to keep it from oxidizing, also to purge the entire panel, so that



Convair-Fort Worth

Two large furnaces . . .
in the brazing area are served by cars which run on rails on a transfer car, so the assembly can be moved to various operations

prior to brazing time, the panel, braze box and retort contain nothing but argon. After 2½ hr at the purge station, the car and retort are transferred to the brazing furnace. Here temperature is raised until the panel, through recorded thermocouples, has reached 1815 F (brazing temperature). This temperature is maintained for 15 min, then the furnace is cut off and fast cooling takes place. When panel temperature has been reduced to 1400 F, the furnace is leveled off to maintain 1400 F for 90 min. At the end of this period, called the "transformation period," the car and retort are removed from the furnace and placed in an air-cooled chamber to accelerate the cooling cycle.

A recorder shows panel temperature all through the heating, cooling and chilling (to -20 F) cycles. Periodic checks are also made on vacuum, atmosphere flow rate, and dewpoint. Variations are noted on the panel-history sheet.

After heat-treat, the retort is removed from the furnace, cooled, then opened so the vacuum bag can be moved to the disassembly area. Here the vacuum sheet is removed and the heat-treat tab taken out. (This is a clean strip of metal like that in the assembly that goes through all operations with the panel, then is machined to shape and tested in tension to check the heat-treat.)

The panel is lifted from the reference tool (which will be refinished for reuse) and cleaned of antibraze compound and globules of brazing alloy (which would braze shim sheets, etc, to the panel if antibraze were not used). Wrapped in paper, the panel is placed in a deep-freeze set at -20 F for complete transformation. The panel is next placed in an ageing oven for 90 min at 1050 F. The heat is considerably less than that for brazing, therefore brazed joints will not be affected or configuration altered.

After final heat-treatment, vent holes in the panel are cleaned and sealed with a plastic compound which, after curing, will retain enough elasticity to accommodate expansion of entrapped atmosphere at high altitudes. The sealant also prevents entrance of fluids during Vapor-Blast cleaning to remove discoloration or contamination and to maintain color match.

A thin protective solution is wiped over the panel to protect the surface from fingerprints, oil, or other contamination, and the rigorous final testing begins. First is checking of dimensions and configuration, then complete radiographic inspection (described in detail in *AM*—Dec 17 '56, p125). X-ray results and all data recorded on the history sheet are used in evaluation. Every void or core separation, fillet sizes, and other factors are considered. If quality is borderline on the rigid specifications, the panel and results are presented to a Material Review Board.

As can be seen from this outline, manufacture of brazed panels is an exceedingly critical and difficult operation—at this point actually using severe tryout and test procedures in production. Methods are being altered constantly as production increases, but in no case can a method be used that reduces the quality, for these panels are in extremely critical service, in which weight, strength and safety are all under rigid control.

ACKNOWLEDGMENT

Rarely has it been this author's good fortune to have the whole-hearted assistance of so many qualified men in preparation of a manuscript. Companies and individuals have been unstinting of their time and resources in supplying requested factual data and illustrations. In addition, the manuscript has been reviewed by engineers of these companies:

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Convair (San Diego), Division of General Dynamics Corp.

Convair (Fort Worth), Division of General Dynamics Corp.

Douglas Aircraft Company

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Hexcel Products Inc

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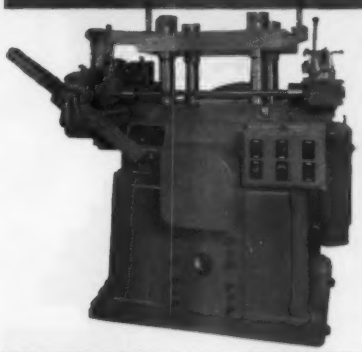
here's production you can plan on with

BRANDES

AUTOMATIC PRESSES

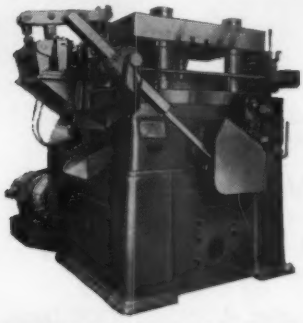


BRANDES 90 TON PRESS

All Brandes Presses are built for ease of operation, with friction clutch and automatic lubrication standard equipment. The vertical bolt lines hold the vertical "V" ways which guide the lower slide. The scrap cutters have heavy square gibbing with exceptionally long ways. The position of the scrap cutter and blades is adjustable.

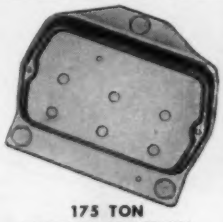
90 TON PRESS PRODUCTION

—Cover 1⅛" deep—.035" C.R.S. at 75 strokes per minute.



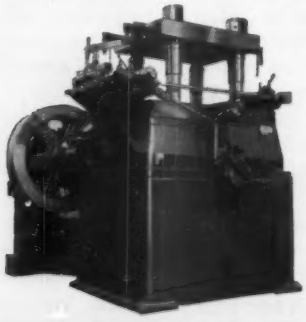
BRANDES 175 TON WIDE BED PRESS

Like all Brandes Presses, the 175 ton features larger die areas—longer die life —patented multiple "V" guides assuring perfect die alignment—low center of gravity—elimination of special pits. Die clearance on the 175 is 28" F to B and 60" R to L.



175 TON PRESS PRODUCTION

—Cover .050" C.R.S.—¾" deep at 75 strokes per minute.



BRANDES 550 TON PRESS

Note the sturdy construction of this press which incorporates all the exclusive performance features of the smaller units described above. The quick feed eccentric is standard on this size machine as is the design arrangement of single back-gear. This press accommodates a die up to 10 ft. in length. Special width and length built on request.

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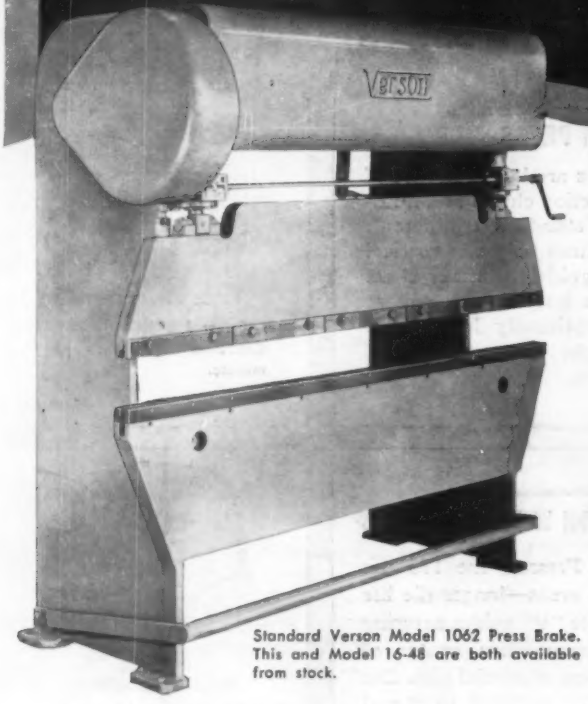
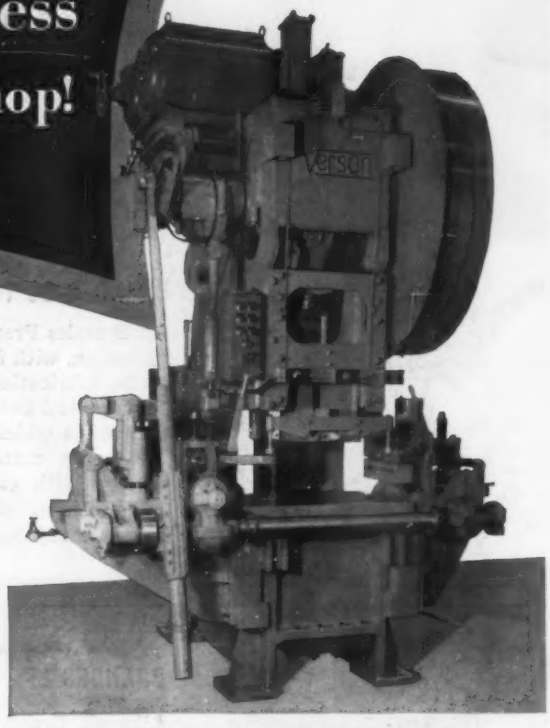


Standard Verson Model 1062 Press Brake. This and Model 16-48 are both available from stock.



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Interference-Fit Threads . . I

SOURCE: A tentative trial standard developed for the Industrial Fasteners Institute and to be published by the American Society of Mechanical Engineers, when approved by the American Standards Association

table 1—EXTERNAL THREAD DIMENSIONS FOR CLASS 5 FIT

Size	Major Diameter†						Pitch Diameter†		Minor Diameter†
	Driven in ferrous >160 Bhn§ $L_e = 1\frac{1}{4}D$		Driven in brass and ferrous ≧ 160 Bhn‡ $L_e = 1\frac{1}{4}D$		Driven in nonferrous except brass•• $L_e = 2\frac{1}{2}D$				
	(Max)	(Min)	(Max)	(Min)	(Max)	(Min)	(Max)	(Min)	(Max)
¼ -20	0.2470	0.2408	0.2470	0.2408	0.2470	0.2408	0.2230	0.2204	0.1932
5/16-18	0.3080	0.3020	0.3090	0.3030	0.3090	0.3030	0.2829	0.2799	0.2508
⅜ -16	0.3690	0.3626	0.3710	0.3646	0.3710	0.3646	0.3414	0.3382	0.3053
7/16-14	0.4305	0.4233	0.4330	0.4258	0.4330	0.4258	0.3991	0.3955	0.3579
½ -13	0.4920	0.4846	0.4950	0.4876	0.4950	0.4876	0.4584	0.4547	0.4140
9/16-12	0.5540	0.5460	0.5580	0.5495	0.5580	0.5495	0.5176	0.5136	0.4695
⅝ -11	0.6140	0.6056	0.6195	0.6111	0.6195	0.6111	0.5758	0.5716	0.5233
¾ -10	0.7360	0.7270	0.7440	0.7350	0.7440	0.7350	0.6955	0.6910	0.6378
⅞ -9	0.8600	0.8502	0.8685	0.8587	0.8685	0.8587	0.8144	0.8095	0.7503
1-8	0.9835	0.9727	0.9935	0.9827	0.9935	0.9827	0.9316	0.9262	0.8594
1 ⅛-7	1.1070	1.0952	1.1180	1.1062	1.1180	1.1062	1.0465	1.0406	0.9640
1 ¼-7	1.232	1.220	1.2430	1.2312	1.2430	1.2312	1.1715	1.1656	1.0890
1 ⅜-6	1.356	1.341	1.3680	1.3538	1.3680	1.3538	1.2839	1.2768	1.1877
1 ½-6	1.481	1.467	1.4930	1.4788	1.4930	1.4788	1.4089	1.4018	1.3127

•The tables are based on externally threaded members being steel ASTM A-325 (SAE Grade 5) or better.

†All dimensions are in inches, for rolled, cut or ground threads.

§In ordering, add OD limits in the $D \times L$ description. Thus "½-13 (OD 0.4920/0.4846) x 2½ in. ASA Class 5 tap end external thread type—."

‡In ordering, it is not necessary to specify the OD. Thus $D \times L$ description automatically calls out the OD limits.

••In ordering, it is not necessary to specify the OD. Thus $D \times L \times T \times N$ description automatically calls out the OD limits.

table 2—INTERNAL THREAD DIMENSIONS FOR CLASS 5 FIT

Size	Ferrous Material			Nonferrous Material			Virtual Diam (Pitch Diam)		¹ Major Diam
	Minor Diam		Tap Drill	Minor Diam		Tap Drill	(Min)	(Max)	(Min)
	(Min)	(Max)		(Min)	(Max)				
¼ -20	0.1959	0.2060	13/64	0.1959	0.2060	13/64	0.2175	0.2201	0.2500
5/16-18	0.2524	0.2630	G	0.2524	0.2630	G	0.2764	0.2794	0.3125
⅜ -16	0.3073	0.3184	O	0.3073	0.3184	O	0.3344	0.3376	0.3750
7/16-14	0.3736	0.3813	3/8	0.3602	0.3721	U	0.3911	0.3947	0.4375
½ -13	0.4313	0.4396	7/16	0.4167	0.4290	27/64	0.4500	0.4537	0.5000
9/16-12	0.4882	0.4972	12.5mm	0.4723	0.4850	31/64	0.5084	0.5124	0.5625
⅝ -11	0.5444	0.5542	35/64	0.5266	0.5397	17/32	0.5660	0.5702	0.6250
¾ -10	0.6614	0.6722	43/64	0.6417	0.6553	16.5mm	0.6850	0.6895	0.7500
⅞ -9	0.7768	0.7888	25/32	0.7547	0.7689	49/64	0.8028	0.8077	0.8750
1-8	0.8901	0.9036	57/64	0.8647	0.8795	7/8	0.9188	0.9242	1.0000
1 ⅛-7	0.9998	1.0152	1	0.9704	0.9858	63/64	1.0322	1.0381	1.1250
1 ¼-7	1.1248	1.1402	1 ⅛	1.0954	1.1108	1 7/64	1.1572	1.1631	1.2500
1 ⅜-6	1.2286	1.2466	1 15/64	1.1946	1.2126	1 13/64	1.2667	1.2738	1.3750
1 ½-6	1.3536	1.3716	1 23/64	1.3196	1.3376	1 21/64	1.3917	1.3988	1.5000

All dimensions are in inches, unless otherwise specified.

Continued on page 173

American Machinist REFERENCE

...the BIGGEST story on spot welding!

Welding engineers testing record setting spot welder. Federal has been commissioned to build several more of these giants for aircraft manufacture.

Federal Built 14 ft., 28 ton giant goes into operation on west coast . . .

The biggest thing in aircraft spot welding—that's the huge new Federal Three Phase Frequency Converter Spot Welder designed to make spec plus welds on the tail section of a new commercial jet airliner.

More than 13 feet tall, the big welder weighs over 58,000 pounds, and has a special throat, or work clearance area, of some 2500 square inches.

The design and manufacture of the 12 ton unipolar transformer having an output in excess of 100,000 amperes and the requirements of meeting rigid deflection specifications on this large throat machine were just a few of the new problems encountered on this project. Federal experience and facilities once more provided the correct solutions.

Here again, is proof that large or small—standard or special—*Federal Stays First in Resistance Welding.*

Federal® WELDERS

Warco® PRESSES

The Federal Machine and Welder Co.

WARREN, OHIO

Interference-Fit Threads . . II

table 3—INTERFERENCES AND ENGAGEMENT LENGTHS FOR CLASS 5 FIT

Size	Interferences on Pitch Diam		Engagement Lengths, External Thread Lengths and Tapped Hole Depths					
			In brass and ferrous			In nonferrous except brass		
	(Max)	(Min)	L_e*	T_s†	T_h min§	L_e*	T_s†	T_h min§
1/4-20	0.0055	0.0003	5/16	3/8 −.000 +.125	3/8	5/8	11/16 −.000 +.125	11/16
5/16-18	0.0065	0.0005	25/64	15/32 −.000 +.140	15/32	25/32	55/64 −.000 +.140	55/64
3/8-16	0.0070	0.0006	15/32	9/16 −.000 +.156	9/16	15/16	1 1/32 −.000 +.156	1 1/32
7/16-14	0.0080	0.0008	35/64	21/32 −.000 +.180	21/32	1 3/32	1 13/64 −.000 +.180	1 13/64
1/2-13	0.0084	0.0010	5/8	3/4 −.000 +.191	3/4	1 1/4	1 3/8 −.000 +.191	1 3/8
9/16-12	0.0092	0.0012	43/64	27/32 −.000 +.210	27/32	1 13/32	1 35/64 −.000 +.210	1 35/64
5/8-11	0.0098	0.0014	25/32	15/16 −.000 +.225	15/16	1 9/16	1 23/32 −.000 +.225	1 23/32
3/4-10	0.0105	0.0015	15/16	1 1/8 −.000 +.250	1 1/8	1 7/8	2 1/16 −.000 +.250	2 1/16
7/8-9	0.0116	0.0018	1 3/32	1 5/16 −.000 +.276	1 5/16	2 5/16	2 13/32 −.000 +.276	2 13/32
1-8	0.0128	0.0020	1 1/4	1 1/2 −.000 +.315	1 1/2	2 1/2	2 3/4 −.000 +.315	2 3/4
1 1/8-7	0.0143	0.0025	1 13/32	1 11/16 −.000 +.359	1 11/16	2 13/16	3 3/32 −.000 +.359	3 3/32
1 1/4-7	0.0143	0.0025	1 9/16	1 7/8 −.000 +.359	1 7/8	3 1/8	3 7/16 −.000 +.359	3 7/16
1 3/8-6	0.0172	0.0030	1 23/32	2 1/16 −.000 +.420	2 1/16	3 7/16	3 25/32 −.000 +.420	3 25/32
1 1/2-6	0.0172	0.0030	1 7/8	2 1/4 −.000 +.420	2 1/4	3 3/4	4 1/8 −.000 +.420	4 1/8

All dimensions are in inches.
*L_e = Length of engagement.
†T_s = External thread length.
§T_h = Depth of Full Thread in Hole.

Interference fits have long been used for studs and thread-locking screws, but have posed manufacturing and assembly problems. The interference-fit, or Class 5 fit, for coarse threads from ¼ to 1½ in. dia has been modified by reducing the OD but retaining interference on the pitch dia.

Table 1 — page 171 — contains maximum and minimum dimensions for external threads. Regardless of the material into which the stud is driven, the major dia tolerance is set equal to that for a Class 3 thread. However, the length of engagement is varied: for driving in brass and in ferrous material under 160 Bhn—1¼ *D;* for driving in other non-ferrous material—2½ *D;* and in both cases the minimum OD limit is set at about the minimum for Class 2A. For driving in ferrous materials of 160 Bhn or harder, the length of engagement is 1¼ *D* but the maximum and minimum OD limits have been reduced further.

Table 2—page 171—gives data on internal-thread dimensions. For the pitch dia Class 3 tolerances apply for all materials. For the minor dia of hole, or ID, Class 3 fit applies for all sizes in non-ferrous material and up to ⅜ in. screw size in ferrous material, and slightly larger thereafter.

Table 3—above—gives the external thread length and the depth of tapped hole. For a length of engagement L_e = 1¼ *D*, the values are set at 1½ *D* (− 0, + 2½ pitches). For L_e = 2½ *D*, the values are established as 2¾ *D* (−0, + 2½ pitches).

For driving Class 5 studs in ferrous material, a noncarbonizing type of lubricant must be used and should be applied to the hole.

Studs produced to tabulated values, using SAE Grade 5 heat-treated, medium-carbon steel, or better, will provide adequate torque conditions. In many applications, case-carburized or medium-carbon steel that has not been heat-treated will prove satisfactory. The tentative standard does not apply to externally threaded members made of stainless steel, silicon bronze or brass. For such materials, it is likely that the listed dimensions must be adjusted through experiment.

V. P.—PRODUCTION:

"Gentlemen, cost is a very important factor in these new machine parts. Our customers will not pay more for the product, so we've got to produce it for less."

SUPERINTENDENT:

"The production schedules are set up for long runs. If we can figure out some way to save money on the machining operation and on tools, we can lick this problem."

CHIEF DESIGN ENGINEER:

"We've got the design worked out for an absolute minimum of machining operation. The answer is going to have to be to increase our feeds and speeds and figure out how we can save money on tools."

STEEL BUYER:

"The answer is obvious. We'll use a Copperweld Leaded Alloy. The tiny particles of lead in the steel act like a lubricant. It will cut our machining time by as much as ⅓, and can increase tool life as high as 100%. It may even eliminate the final finishing operation."

ARISTOLOY STEELS

COPPERWELD STEEL COMPANY • STEEL DIVISION • WARREN, OHIO

EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N. Y.

Cost of Assembly

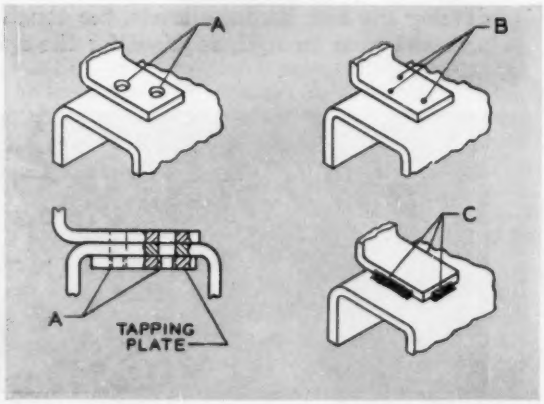
A guide used in the automotive industry

COMPARATIVE COSTS FOR SEVEN ASSEMBLY OPERATIONS

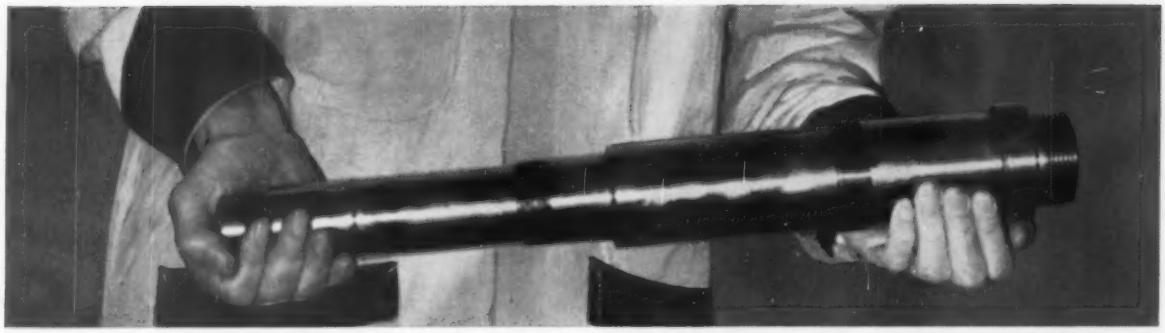
Operation or Material	Cost Factor	Qty & Pos	COST COMPARISONS						
			Spot Welds	Proj Welds	Rivets	Arc Welds	Bolts & Nuts	Bolts & Tapping Plate	Blind Rivets
Method			1	2	3	4	5	6	7
Spotwelding	100	3B	300					200	
Projection Welding	100	3B		300					
Forming Weld Proj	89	3B		267					
Punching Hole	89	4A			356		356	356	356
Rivet	70	2A			140				
Driving Rivets	96	2A			192				192
Arc Welding (1 inch)	250	3C				750			
Bolt	115	2A					230	230	
Nut	106	2A					212		
Lockwasher	18	2A					36	36	
Assembling Bolts	136	2A					272	272	
Tapping Plate (Matl)	321	1A						321	
Drilling Hole	89	2A						178	
Tapping Hole	89	2A						178	
Blind Rivet	742	2A							1484
TOTAL COST			300	567	688	750	1106	1771	2032

Methods of assembly have an important bearing on cost. The table gives a typical cost analysis covering seven methods for assembling a simple bracket to a carrying member. Cost comparisons are based upon spotwelding as 100. The table is not intended to indicate that the least costly method is the best. Function and strength of assembly must be considered. To apply such a table, you will have to adjust relative costs of performing the various operations, according to conditions in your plant.

Use of such a table will avoid choosing assembly methods without careful consideration of the economics involved. Differences will exist, of course, in the effectiveness of various methods of attachment. But with a cost comparison at hand, the choice is obviously the least expensive method that will do the job satisfactorily. Any such table must take into account plant practices, equipment and facilities, tooling, fixture design, volume and labor costs. An assembly can readily be made by one set of operations in one plant but the sequence of operations in another plant will not be the same because of differences in methods, etc.



Machining Costs Cut 25%
by switch to NEW RYCUT 50



Logan Engineering Co. report shows how you can save up to 30% with a Ryerson leaded alloy

THE PROBLEM—This Chicago manufacturer of precision lathes faced a tough production problem from a time and cost standpoint. Lathe spindles have to be tough and hard with high wear resistance—so the steel Logan originally used was SAE 52100.

But the spindles were turned down and center-drilled from the solid to hole sizes as large as 1⅜". And ID's had to be accurate and free from scoring along the entire length of the spindles. 52100 provided the required mechanical properties but was slow cutting and created production difficulties and a high scrap rate.

Needed: A *free-machining* steel that would develop the high hardness levels, the toughness and wear strength required for the application.

THESE LARGE ALLOY STOCKS . . . also carbon and stainless steels in every shape and size, are in stock at Ryerson. Also call Ryerson for reinforcing steel service, industrial plastics, machinery and tools, etc.

THE SOLUTION—Logan engineers had long been on the lookout for a steel that would solve their production problems so they were eager to try New Rycut 50 when this Ryerson 50-carbon alloy steel with a controlled lead addition was suggested by Ryerson metallurgists.

New Rycut 50 was a success from the start! Now, after two years, Harry Peterson, Logan plant superintendent, reports: "New Rycut 50 has saved us a consistent 25% of our former costs in the production of lathe spindles. Rycut's uniform machining and hardening properties have reduced scrapped parts to a minimum and the steel has proved satisfactory in every way."

This is just one of many case histories in our files on the steels in the Rycut series—New Rycut 50, Rycut 40 and Rycut 20. Actual performance records show machinability increased as much as 50% . . . tool life lengthened as much as 300% when a Rycut steel is used in place of a standard alloy of comparable mechanical properties.

To get further information on these great new cost-cutting steels or for quick shipment of any steel requirement, call or write your nearby Ryerson plant.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE • CINCINNATI CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

Talking Shop...

TV Influence

PERHAPS it is the influence of those ever-growing jackpots on the quiz shows, but US Steel this month started a new suggestion plan with a top award of $10,000. But just as few things come as easy as those jackpots, winners of the top award will have to come up with an idea that saves $50,000 in the first year. In short, under the new plan, 20% of the first year's savings will be paid to the suggestor—anywhere from $10 to $10,000.

Youth Search

AT the Wisconsin State Fair last fall there was an area in which three machinist apprentices performed all the machining operations in producing desk-pen holders. Five complete assemblies were produced per hour and a drawing was held every half hour to pass some of them out to the public (which must have insured a good crowd). The apprentices, who worked in two shifts, were supplied by Wisconsin firms to publicize the growing opportunities offered by apprenticeship. A total of 28 companies cooperated in supplying the men, equipment, and money needed. Such apprenticeship exhibits have been sponsored by the state Industrial Commission for many years, but this was the first year that a live-action machining exhibit was offered. We doubt if they'll ever know how many careers were influenced, but the training supervisors involved already have found one good result: top managements of the 28 participating companies are more sold on apprentice training than ever.

Russian Steel

SOME readers have complained that our series on the Soviet Union has tended to talk more in percentage gains than in totals. Where this is true, you'll have to blame it on those cagey Russians. We are indebted to the United Nations, however, for the figures on steel output last year. The UN's Economic Commission for Europe reports from Geneva that 1956 Soviet steel output was 48.6 million tons, an increase of 3.3 million tons. (US production, held down by the strike, dropped 1.6 million tons, but was still at more than twice the Soviet rate—104.5 million tons). But think how little of the Russian steel went into what we think of as the "necessities" of life—such as vacuum cleaners and TV sets—and how much of it went into capital equipment. The thing we must ponder about Soviet Metalworking is not so much its size as its rate of growth.

High-tensile Steel

HEAT treating is the key to the high-tensile aircraft steels but all the operations can be a bit touchy. At Rohr Aircraft they fabricate weldments with a minimum tensile strength of 180,000 psi. Starting with AMS 6428 (nickel-chromium-molybdenum-vanadium) steel, Rohr flame cuts sections, hot forms to shape, then welds them while clamped in a jig. The heat treating cycle is in four steps: First, the weldment is austenitized in a neutral salt bath. Second, it is marquenched in molten salt. Third, an oil quench. Fourth, a hot-water rinse. The neutral hardening salt bath is an Ajax unit operating at 1600 F. It is 4 x 4 x 16 ft and holds 17½ tons of salt. Methyl chloride is added to the salt to control decarburization. After the high-tensile heat treat the parts are oven tempered to specified properties.

Throwaway Test

A CAREFUL evaluation of carbide throwaway tools has just been completed by Hyster Co. The same grade of carbide (Kennametal K 21) was used in brazed and insert tools in a Warner & Swasey No. 2 lathe. The tests were made on a 13-in. dia steel plate that is used in a carrier-trunnion. Turning operations were with 0.0054 in. feed and 3/16-in. depth of cut. Facing operations had 0.013-in. feed and ¼-in. depth of cut. Both operations were at a maximum speed of 455 sfpm. Average tool cost per piece was 7.4¢ for the brazed tools and 1.6¢ with the throwaway inserts. Additional savings were obtained from the reduced down time for changing tools with the inserts.

Interference

A Signal Corps officer warns that the widespread use of electronic equipment is using up the electromagnetic spectrum and impairing our defense. He refers to this spectrum as "that most critical of resources." Everybody should think the problem he is working on is important, but even if we downgrade the General's warning to a realistic level—he has a point. We're going to have to watch out that unnecessary interference isn't broadcast into the air waves or we'll find our lathes being licensed by the FCC.

For 1957: Slowing Boom in Capital

WASHINGTON—The capital spending boom will keep rolling through 1957, but the gain will be only a third as great as it was last year. That's the substance of a survey of industry spending plans for new plant and equipment taken by the Securities & Exchange Commission and the Commerce Department. It's the first government survey that assesses 1957 as a whole.

Slightly Less Rush

For metalworking industries, it indicates a continuance of strong demand, but with some lessening of the rush for new production equipment that has marked some lines the past two years.

The amount of gain foreseen for 1957—6.5%—is slightly less than government economists had expected. They had thought 1957 would run about 10% ahead of 1956. Last year, the gain in capital spending was 22%.

Two hints on business expectations, both significant to the metalworking industries, are contained in the report:

- Sales are expected to rise 8% at the manufacturing level, though only 4% at retail. Revenues by utilities are estimated to be 9% higher. These are all in dollar values, and particularly at the manufacturing level, may turn out to be mostly because of price rises rather than increases in physical volume.
- Outlays for new plant and equipment are expected to remain as high in the second half of the year as in the first—$18.6 billion and $18.8 billion respectively. There is no hint of a gathering rush to cancel expansion projects.

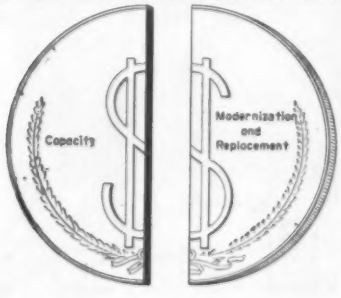
This is the second survey of capital spending plans covering 1957. The first was taken late last year by the McGraw-Hill Department of Economics, and showed an 11% expansion was being planned. However, the two surveys are not strictly comparable. SEC-Commerce, for example, includes many more small companies. Analysts think the greater part of the difference between the survey results can be explained by this difference.

The SEC-Commerce survey reveals a mixed picture when industry trends are compared. A majority expect gains—some of them large. Nonferrous metals lead with an expected 100% increase. Aircraft leads a planned 33% rise in the non-automobile transportation category. Steel, non-electrical machinery and chemicals are expanding more than

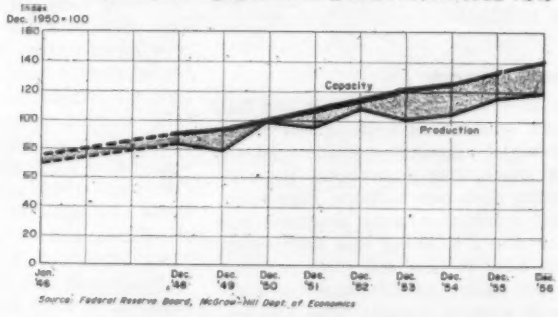
THE CAPITAL GOODS DOLLAR: Where

MANUFACTURERS HAVE SPENT $113 BILLION ON NEW PLANT AND EQUIPMENT SINCE THE END OF WORLD WAR II

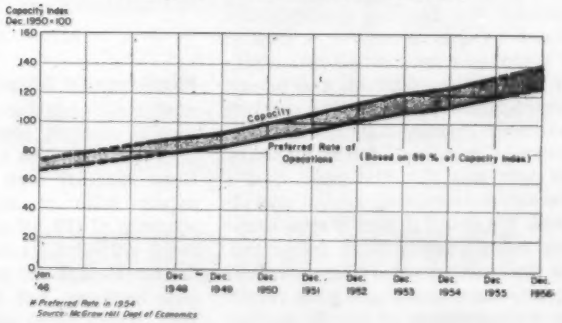
OF THE CAPITAL EXPENDITURE DOLLAR ABOUT HALF WENT FOR NEW CAPACITY, THE OTHER HALF FOR MODERNIZATION AND REPLACEMENT



MANUFACTURING CAPACITY HAS DOUBLED SINCE END OF WORLD WAR II WHILE PRODUCTION ROSE 72%



FOR EFFICIENT OPERATION MANUFACTURERS, ON THE AVERAGE, PREFER TO WORK AT 89 % OF CAPACITY *


Capacity Index Dec. 1950 = 100
Capacity
Preferred Rate of Operations
(Based on 89 % of Capacity Index)
* Preferred Rate in 1954
Source: McGraw Hill Dept of Economics

Spending

25%. Utilities expect a 24% jump. Among the downs, autos show the deepest retrenchment proportionately, down 22%.

On balance, the 6.5% gain has a healthy undertone. It is not based on the spectacular performance of a few leaders, but is reported in by most of the industrial groups. Solid expansion is in store during the year for most industrial lines, if the survey is borne out. The industries cutting their plant and equipment outlays are the ones in the minority.

Among durable goods makers, for instance, autos and the stone, clay and glass products category show declines, while five industries plan increases. The gainers are: primary iron and steel, nonferrous metals, both electrical and nonelectrical machinery and non-automobile transportation. The biggest gainer is non-

(continued on next page)

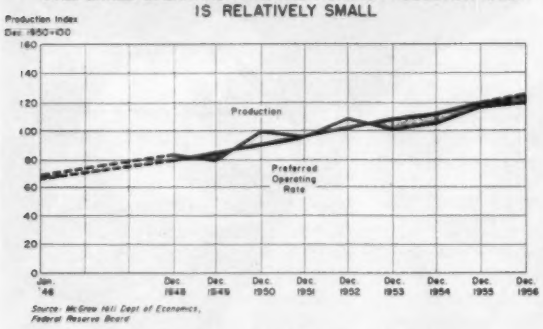
Business's Plans for Capital Goods Spending

(Millions of dollars)

Industry	1955	1956	1957 (estimated)	% increase '57 over '56
Primary iron and steel	$ 863	$1268	$1650	14
Primary nonferrous metals	214	412	821	99
Electrical machinery, equipment	436	603	692	14.7
Machinery (except electrical)	809	1078	1394	29.6
Motor vehicles & equipment	1128	1689	1302	–22.9
Other transportation equipment	274	440	595	35
Stone, clay, glass products	498	686	633	– 7.7
Other durable goods	1214	1447	1411	– 2
ALL DURABLE GOODS	5436	7623	8498	11.1
Food & beverages	718	799	798	—
Textile mill products	366	465	379	–18
Paper & allied products	518	801	835	4
Chemicals & allied products	1016	1455	1799	24
Petroleum, coal products	2798	3135	3403	8.5
Rubber products	150	201	208	3
Other nondurables	437	475	494	4
ALL NONDURABLE GOODS	6003	7331	7916	8
ALL MANUFACTURING	11,439	14,594	16,414	12.5
Mining	957	1241	1221	– 2
Railroad	923	1231	1468	19
Other transportation	1602	1712	1826	7
Public utilities	4309	4895	6062	24
Communications & commercial	9471	11,048	10,370	6
ALL BUSINESS	28,701	35,081	37,361	6.5

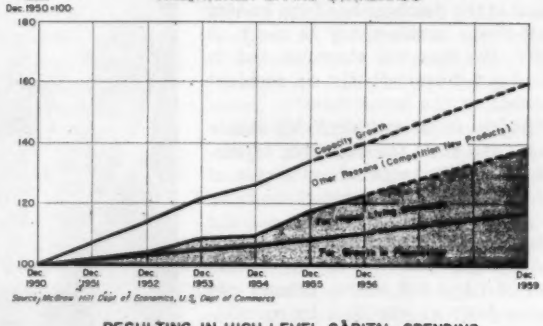
It Goes Today, and Where It's Headed

SO THE GAP BETWEEN PREFERRED OPERATING RATE AND ACTUAL PRODUCTION RATE IS RELATIVELY SMALL



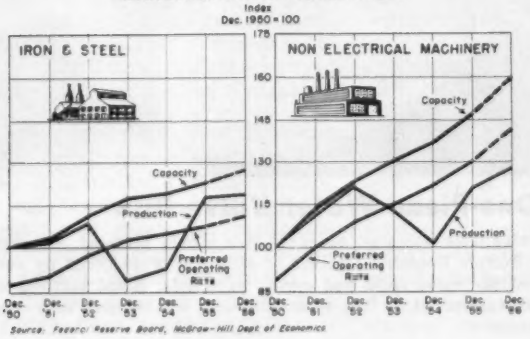
Source: McGraw Hill Dept of Economics, Federal Reserve Board

MANUFACTURERS CAN BE EXPECTED TO CONTINUE TO INCREASE CAPACITY BECAUSE OF AMAZING POPULATION GROWTH AHEAD AND HIGHER LIVING STANDARDS



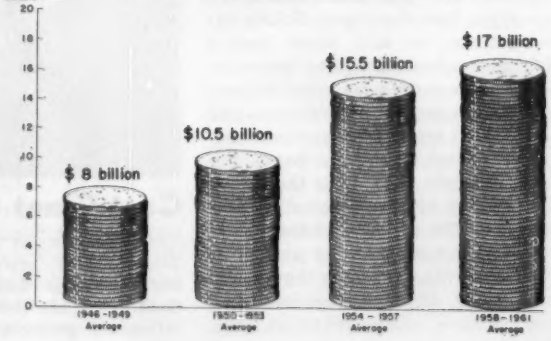
Source: McGraw Hill Dept of Economics, U.S. Dept of Commerce

SIZE OF THE GAP DIFFERS IN MANUFACTURING INDUSTRIES



Source: Federal Reserve Board, McGraw-Hill Dept of Economics

RESULTING IN HIGH LEVEL CAPITAL SPENDING BY MANUFACTURERS IN NEXT FEW YEARS



Stampers Stress Plant Safety At Cleveland

CLEVELAND—Two ways of making the nation's stamping plants safer places to work in keynoted discussions at the Pressed Metal Institute's accent-on-safety spring meeting here early this month.

One out of every three industrial accidents happens in the process of handling materials, Robert C Brady of W B McClelland Co, Cleveland, told the stamping manufacturers. And, he said, in New Jersey alone plant injuries such as wrenched backs and hernias resulting from lifting and shifting materials cost plant owners more than $3 million last year.

How can this high injury rate be cut down? First off, you've got to change your thinking from the negative "It's always been done this way" attitude to one of long-range planning for maximum safety. Many materials handling programs are outmoded even before they get into operation because of shortsighted planning, Mr Brady said. For instance, the actual positioning of material at the machine has been known to increase productivity as much as 35.6% per man per machine, and to cut down tremendously on accident hazards at the same time.

"Safety is an attitude," Mr Brady said, "and so is the changing of material handling methods to arrive at safety. It is much easier to improve on handling methods than on the actual machine cycle."

Accidents ocurring during operation of hand-fed power presses can be cut down at least 50% by installation of air ejection systems, Frank Engstrom of A Schrader's Son & Co, Brooklyn, told the group. Safety investigations, he said, show that a high percentage of power press accidents are caused by man failure, rather than mechanical failure—and that a great many such accidents occur when the operator's hands are in a dangerous position at the end of the machine cycle. Air ejection systems keep the operator's hands away from the danger area by automatic removal of the part from the die after pressing, Mr Engstrom said—and they remove waste materials, too.

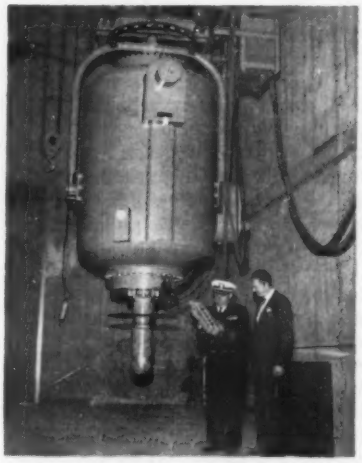
CAPITAL SPENDING (Continued)

ferrous metals, which is posting a 100% increase over 1956.

Among the makers of nondurables, there is only one significant decrease—textiles. Food and beverages expect to equal last year's performance, a small gain is posted by the rubber industry, and substantial increases are planned by chemicals, petroleum, paper.

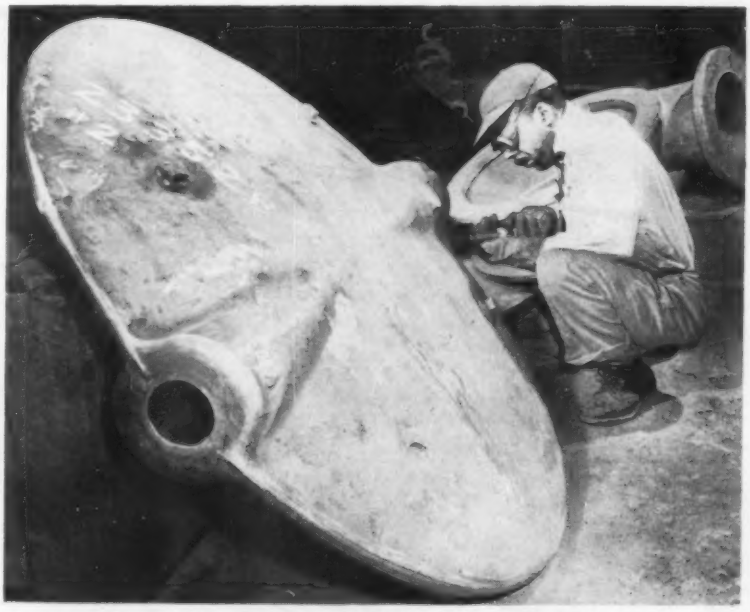
The overall slowdown in the rate of growth for 1957 stems from a number of factors:

- Shortages of goods and money are probably most important. For nine months now, businesses have reported inability to achieve goals, simply because financing cannot be arranged or scarce goods cannot be delivered. Structural steel, for example, has never made up the effects of last summer's strike.
- Some slowdowns may be associated with dropping sales last year, such as autos, or weakening prices as in textiles and copper.
- Rising costs may be playing a key role in some industries. Chemical producers, harrassed by narrower profit margins because of rising costs, and unable to post offsetting price increases because of increasing competition, are planning another big year of expansion, but sharply off the pace they set in 1956. Last year they increased outlays $439 million; this year they expect a rise of $344 million.



Giant X-Ray

Castings for nuclear reactors and other heavy equipment will be inspected for structural weaknesses with this $95,000, 2-million-volt General Electric x-ray unit at Port Chicago, Calif, Naval Magazine.



Cast Giant One-Piece Wafer Valve Disk

This 1701-lb wafer valve disk was cast recently in a single piece at Allegheny Ludlum Steel Corp's Buffalo Foundry. Centers of each side were cored by keeping the mid portion of the valve solid and coring each side. Metal sections are ¾ in. thick, are of 304 stainless steel. The 48-in.-dia valve will be used in a circulating sea water system

Small Subcontractors Air Troubles

–"Advertised Bids Not Always Best," Pentagon Told

WASHINGTON—The problems of small metalworking companies producing military goods have been outlined anew to Pentagon officials and Congressional leaders in a series of Washington conferences sponsored by the Strategic Industries Association. (This is a three-year-old group of about 150 military contractors and subcontractors—each with under 500 employees but with annual sales of over $1 million—located mainly in California.)

Some Unexpected Views

Contrary to the views of Congressional small business partisans, the SIA members argue that negotiated military procurement—as opposed to advertised procurement—"is not essentially damaging to the interests of small and independent firms and may, in some cases, represent desirable protection to the small originator of technically advanced designs."

Up to now, a House Armed Services Subcommittee headed by Rep F Edward Hebert (D, La), which is investigating military procurement policy, has been pushing for increased defense buying under advertised bidding.

Ads Breed Over-Competition

Says SIA: "Widely advertised procurement may bring about extensive competition among inexperienced firms with resulting unintentional below-cost bids. Since everyone who bids must bear the cost of bid preparation, there are frequent instances in which all concerned are the losers —the successful bidder, the unsuccessful, and the government."

But SIA recommends close Pentagon scrutiny of negotiated procurement to stress that "competent independent firms" get a chance to put in their bids for military contracts.

Oppose Long-Term Tool Subsidies

The small metalworking producers put on the line a strong objection to the "extended use" of government-owned plant and production equipment for manufacture of military goods. It was put this way:

"Privately-financed independent industry faces inequities when it competes with firms whose facilities have been furnished by government." This competition is both direct (in respect to competitive bidding) and indirect (in respect to work which US never put out for bid because government-owned equipment is available and its use is encouraged without adequate data on comparative cost).

Government Vs. Private Plants

SIA recommended (1) no further installation of government facilities unless it is determined that existing privately-financed facilities are not available to handle the proposed production or that private firms are unwilling to furnish the added capacity required; and (2) assurances that "component phases" of a new production project be sufficiently identified before provision of government facilities to avoid duplication of existing private facilities.

More Subcontracting Urged

Along these lines, the Association proposed that prime contractors be encouraged to subcontract production of sub-systems and components to "defense specialty manufacturers."

Assistant Air Force Secretary Dudley C Sharp, who heads up the Air Force Materiel Program, backed up the proposal, explained Air Force policy like this:

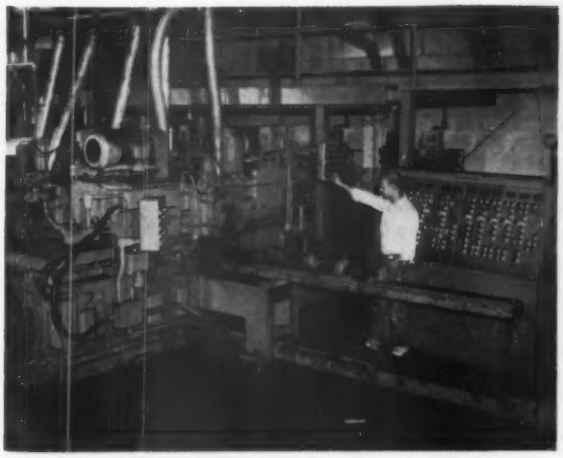
Air Force Agrees

"Under the weapon system concept, the single prime contractor selected to produce the system is made responsible for its overall design, development, and performance reliability. He carries out this responsibility under the supervision and control of the Air Force. Clearly, however, the prime contractor's responsibility does not include complete production of all elements of the weapon system. I emphasize that point because some people have the mistaken belief that once a prime contractor is selected, he has the concurrent authority to tool up to produce all component parts and subsystems. The Air Force view diametrically opposes such a belief and will actively discourage prime contractors from expanding their facilities and enabling themselves to self-produce what they could subcontract."

Other major SIA recommendations:

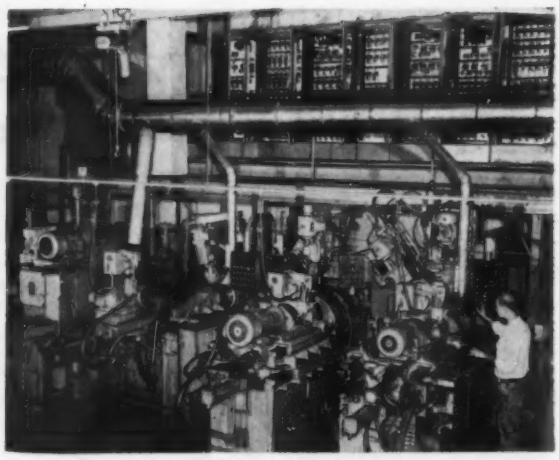
- Armed services procurement regulations should allow interest on loans as a cost item under cost-plus fixed fee contracts. By disallowing such costs, it was pointed out, "the impact . . . is proportionately greater on the small and independent firm which has less access to progress payments and less attraction for equity capital."
- Industrial mobilization planning should be revamped to allow for speedier production increases in case of emergency and faster identification of specialty producers which "fulfill vital roles in design, development and supply of intricate components and sub-systems, but remain presently unidentified in planning." (See Washington column, p107.)
- Proprietary rights should be clarified to protect original designs, data, and specifications developed by small metalworking firms. Says SIA: "the tendency of certain prime contract buyers to seize upon the proprietary designs of prospective suppliers—under the cloak of 'government necessity'—is fostered by the government. . ."
- Renegotiation of defense profits should be revised—or better yet, ended, with the substitution of price redetermination to control "the small number of government contracts in which effective competition cannot be relied upon to restrain prices." But assuming the law's continuation, new exemptions should be enacted: for contracts let after at least three competitive bids and for contracts covered by price redetermination clauses.
- Security regulations be liberalized and unified among the services—providing simpler clearance procedures and the "greatest possible exchange among persons of established security levels as a means to accelerate solution of common problems."

Aside from Assistant Air Force Secretary Sharp's comments on subcontracting, there were few if any signs of how far SIA's proposals will go along these lines.



Flexibility plus run production . . .

on a transfer line is achieved with this 12-station Sundstrand machine that handles 36 kinds of motor frames of varying size (NEMA 180 to 450) automatically. Production quantities run from 40 to 500 of any particular type and production rates are about 70 per hr for the smallest size to 40 per hr for the largest (100% efficiency). Floor space is about 25% of that needed for conventional machines, which would need some 15 operators per shift. This setup takes three per shift.



Setup time is cut . . .

by color-coded spacer blocks on the Sundstrand transfer machine. Block positions limit switch dogs, and setup operator uses a check list to be sure each spacer is in the correct location for a particular job. About 9 hrs are required to change from one frame size to another, and about 1 hr to change the setup for frames of different lengths within a particular size.

$3 Million for Expanded Motor

CLEVELAND—More than 100,000 sq ft have been added to the Ashtabula plant of Reliance Electric and Engineering Co to increase production of ac and dc motors up through 30 hp in size. New manufacturing facilities have added 90,000 sq ft—with 10,000 sq ft more for welding and storage. Plant highlights:

Flexible Transfer Machine

A 12-station Sundstrand transfer unit for machining motor frames of various sizes and types can be advantageously used for production runs as short as 50, 100, or up to 500 of any of 36 different types of frames —in contrast to long runs of the same part commonly associated with such equipment. In each of these different types of frames there are three different dias—and frames can be of two different lengths for each dia. Flexibility of the machine is further supported by good production rates—up to 70 pieces per hour for the smaller frames, and around 40 per hour for the largest. Capital investment for this machine was considerably less than would have been spent for conventional machines, (11 turret lathes, one multiple-spindle drilling machine and one five-spindle drill) to do the same work.

Rough-machined Rabbit

After loading at the first station, ends of frames are faced and a rabbit rough machined on one or both sides—depending on the type of motor frame being processed. The rabbit is used for locating purposes in the third station where the frame is bored half way through. For some frames, this station is also used to semi-finish and chamfer the rabbit. Station 4 is the same as 3 except this work is done at the opposite end of the frame. Fifth station is idle when frames without feet are going through, otherwise these are milled —and at station 6 they are drilled.

Part Turns 180°

The part is turned over 180° in the following station, after which bracket holes are drilled and chamfered, an eyebolt hole is drilled and counterbored, and a locating, or pin hole, is drilled for the stator. On frames with feet, nameplate holes are also drilled in this station. Locating from the stator pin hole, a bracket hole is tapped next—as is the eyebolt hole. At the 10th station, conduit box holes are drilled and tapped and nameplate holes are drilled in those frames that haven't already received them. At station 11, bore is finished all the way through and the frame is unloaded at station 12.

Hydraulic Stations

All stations are hydraulically operated, except No. 5, where a dc Reliance electric drive is used. A square cycle shuttle transfer carries sets of three fixtures—each designed for a different-sized frame and spaced apart to suit spacing of the stations.

Setup time is minimized by color-coded spacer blocks that position limit switch dogs. Setup operators use a check list to make sure each spacer is in the right position when starting a new run. About 9 hours are required to change from one type of frame to another and only one hour is needed to set up for different lengths of frames within one size.

One of the principal advantages of

Dieing machines in tandem . . .

speed output of motor lamination from 3% silicon-steel coiled stock. Speed of two 150-ton Henry & Wright machines is closely coordinated with Selsyn control motors, and varied to suit materials and types of dies. Tandem arrangement achieves maximum flexibility in use of dies

Manufacture

this machine—in addition to manufacturing economy—is the uniformity of results obtained. Control of accuracy is not dependent upon manual skill and consistency. One of the particular features is a Farval automatic lubrication system that reaches all moving parts every 3-min. Oil mist lubrication is used at the heads.

Tandem Dieing Machines

In the stamping area, an unusual tandem installation of two 150-ton Henry and Wright dieing machines speeds production of motor laminations. At this point, the 3% silicon steel coil stock from an uncoiler runs through a leveller with the loop controlled at the first machine. A progressive die pierces the center hole, and, slot detail, and then blanks the rotor lamination from the strip. At the second machine, stator lamination slots are blanked in a single die and the laminations ejected. Scrap continues through the machine to a cutter on the outbound end of the machine. Cut up scrap falls into a vibrating conveyor trough in the floor for transfer to a magnetic belt that carries it to an elevator conveyor for delivery outside the building.

Speed regulation of both machines, (ranging from 60 to 180 strokes per min) is essential for optimum performance and is varied to suit different conditions of the material or different types of dies. A complex variable speed drive is closely coordinated by selsyn control motors.

For short run production, a 45° inclined Minster press of 93-ton capacity is used—also with coil strip. Automatically ejected blanks are delivered to a 5-ton V&O notching press that runs at 1000 strokes per min. Carbide dies used in this setup produce 750,000 to 4-million notches per grind, depending upon complexity of slot details. Blanks from this press are returned to the Minster press where rotor "cookies" are separated from stator laminations.

Silicon Steel Stock

The tough and abrasive stock used for these parts is 24 gage (0.025 in. thick) motor grade silicon steel—about 39% thicker than material previously used. Although a number of problems have developed because of using the heavier material, advantages outweigh disadvantages. For one thing, the more expensive material produces a better core—one that is less springy and with less distortion. It eliminates stiffening wings in the assembly and permits manufacture of a shorter core in a motor with more hp in the same space. With fewer laminations per core, there is less stamping, less presswork, and a resulting overall cost reduction. Rotor laminations are stacked and shipped to the die-cast foundry where bars, rings and fan blades are cast integrally with the laminations to form rotor cores.

Inert-Gas Welding

The stator laminations are welded to form cores in automatic inert-gas-shielded tungsten-arc setups. Mild steel rod is added to the welding puddle to dilute the silicon content at the weld head. This practice also reduces spatter and eliminates slag.

After welding, station cores are placed on alloy steel trays for automatic transfer through an oxidizing and annealing furnace. At the charging table, each tray trips a limit switch to energize a circuit that prevents entry to the charge vestibule of the furnace until the tray previously loaded is cleared into the furnace. At the discharge end, cores enter transfer dollys and are automatically carried to an adjacent storage conveyor which delivers them to the electrical and finishing area. The annealing cycle is 8½-hr from start to finish.

Small quantities of motor shafts, (under 100) are turned in a Monarch air-gage tracer lathe designed for quick setup and adapted to use either flat or round templets. Here, the first shaft—made on an engine lathe—is used as the templet for the run. Grinding follows contour turning and keyways are cut in a plain milling machine.

High Shaft Production

High-volume shaft production is handled by two Monarch "Mono-Matics" equipped with air-gage tracer control. In these setups flat templets are used. Landis plain hydraulic machines are used for grinding these shafts. The grinders have hydraulic straight in-feed attachments and double-contact electrical sizing gages for consistent control over size regardless of wheel wear. Transfer in V-racks on a gravity feed roller conveyor follows to bring the shafts to a Sundstrand "Rigid-Mil" for cutting keyways.

Other Operations Similar

Other operations in this plant are set up on a similar basis. Brackets, bearing caps, and other components are moved on conveyors of various types and machined in setups specifically designed for the type of production encountered in motor manufacture. Power units for all Reliance V S Drives on the machines are mounted on overhead platforms suspended from roof beams. Reduced setup time is not allowed to affect quality and in all areas storage methods follow a first-in—first-out system. "Flow" racks for frames, cores, rotors, shafts, and others carry material through the plant to processing and storage in a steady flow—in which the first parts to go in are the first out. In general, the machining area provides:

- Machine layout for maximum efficiency in material handling.
- Short work cycles that reduce process inventory and maintain a consistent, uniform flow of work.
- Statistical quality control in inspection—supplemented by production gages of the same kind used in inspection.

Tool Distributors See '57 as Prosperous Year

PALM SPRINGS, CALIF—Orders booked by machine tool distributors thus far in 1957 have been good, despite tight money and scattered talk of letdowns in some industries, Joseph F Owens, Jr, president of the American Machine Tool Distributors Association and president J F Owens Machinery Co, Syracuse, NY, reported to the 33rd spring meeting of the association at El Mirador Hotel March 6-7. The volume in January and February was equal to or surpassed that in the same months of 1956. A survey among a cross-section of members shows, in fact, that new orders in certain areas--metropolitan New York, the South, most of the midwest, southwest and Pacific northwest—are up 10% to 50% over last year.

Know the Market Potential

Knowing the market potential for machine tools, Mr Owens emphasized, is one of the principal jobs of distributors. It is so important that it was the theme of the spring meeting. Beyond that, distributors should be equipped to offer and expedite financing arrangements best suited to customers' needs. They should be as familiar with availability of effective and salable leases and conditional sales contracts as with the capabilities of their machines.

Mr Owens suggested that every distributor keep abreast of market changes in his territory, such as seeking out new customers, and of changing buying methods. With recent expansion and diversification trends, many plants now have several manufacturing and product divisions and as a result it is necessary to contact eight to ten executives instead of one or two as formerly.

Distributors should ask themselves these questions, Mr Owens said: 1) Are we getting our share of the expanding market for machine tools in our areas?; 2) are we alert to what our competitors are doing?; 3) are we building management in depth to assure continuity, such as attracting new sales engineering and other skills?

Rumor has it that the Federal Bureau of the Budget approved far less than the $150 million maximum allowable in the 1958 budget of the

AMTDA PRESIDENT OWENS . . .
"The trend is up . . . shipments of machine tools sold through distributors will at least maintain 1956 levels."

Defense Department for machine tool replacement and modernization, before sending the budget to Congress, Henry R Hanson, chairman of the government relations committee and vice president of William K Stamets Co, Cleveland, declared.

Mr Hanson outlined the government's action on machine tools since World War II and warned that the present replacement program of the armed services bears watching to prevent the bypassing of distributors. He reported no tendency in Washington agencies to relax the rules on nondenfense leasing of government-owned tools. In connection with the Internal Revenue Service's proposed revision of Bulletin F (see editorial on p119), Mr Hanson advocated the gathering of up-to-date statistics on the useful life of machine tools from the builders themselves and then presentation of the data to the Internal Revenue Service.

Builder-Distributor Liaison

An adequate system of communications between the machine tool builder and distributor is essential for the proper relationship between the two, Jerome A Raterman, president of the National Machine Tool Builders' Association and president of Monarch Machine Tool Co, said. The best method of communication is for the two to sit down and talk frankly about problems affecting them. Mr Raterman stressed that in this day of highly complex machine tools it is out of the question for the distributor to have on his staff either sales or service specialists familiar with the intimate details of the builder's machines. The responsibility for providing these essential specialists, therefore, falls on the builder. Selling machine tools thus has become a cooperative venture of the combined sales staffs of both the distributor and the builder.

Mr Raterman pointed out that the distributor is in possession of two highly perishable commodities. One is his contact with customers, for which there is no substitute for personal contact itself. The other is the selling franchise from the builder that he holds. It behooves the distributor to make sure that these two commodities are kept intact.

A panel discussion on surveying the market potential for machine tools was a feature of the meeting. Robert D Lawson, vice president and sales manager of the Grinding Machine Division of the Norton Co, represented the builder's point of view, and I B Rabel, president of the Star Machinery Co, the distributor's point of view. Rufus B vonKleinsmid, chancellor of the University of Southern California, was a featured speaker.

Army Engineers to Probe Causes of Weld Failures

FORT BELVOIR, VA—Private firms and government agencies are invited to submit case histories of welding failures for discussion by a panel of experts during a conference on welding engineering to be held here April 29-May 1 by the Army Corps of Engineers Research and Development Laboratories.

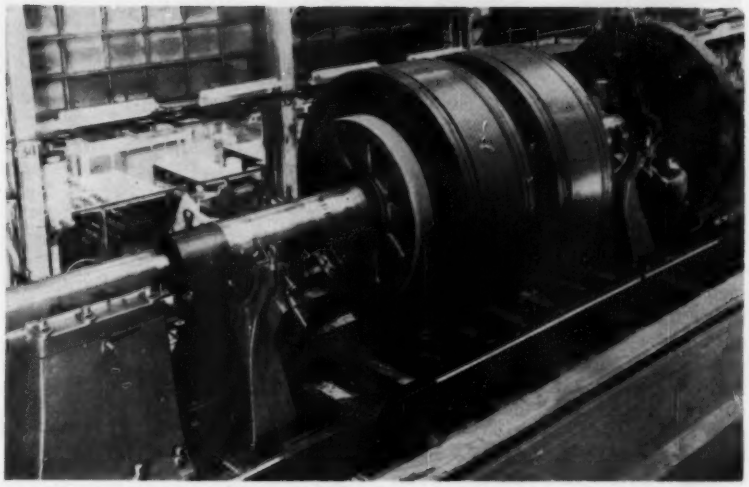
Firms submitting such case histories are invited to send representatives to the conference to hear the discussions. Panelists will include welding authorities from industry and from government, who will look into influences of design, specification or inspection on failure of the welds. Case history information should be submitted to Allan L Tarr, Engineers Research & Development Laboratories, Materials Branch, Fort Belvoir, Va.

South...

Looking South . . .
Clinton, NC, is agog at being chosen as the location of a giant (name not given) industry. Firm, whose sales last year exceeded the $300-million mark, is expected to occupy an existing facility, has asked that an additional 50 acres of land be made available for expansion . . . **Eastman Kodak** is geared to spend $21 million on facilities in Tennessee and Texas . . . **Lockheed Aircraft's** Georgia Division at Marietta has an order for modification of an additional 92 stratojet bombers, B-47's. Work will start in April, run through December . . . **Butler Manufacturing Co,** Ensley, Ala, producer of pre-engineered steel buildings, farm equipment, oil tanks, and custom-fabricated work, is starting a $300,000-expansion program . . . **Reynolds Metals** has purchased 891 acres of land near its Listerhill, Ala, operations. Site, located on Lake Wilson, will provide barge, dock, and transportation facilities . . . **Atlanta Paper Co,** manufacturer of packaging machinery, has taken over the **Palm Container Corp** of Miami. **Palm** will continue to operate as a separate company . . . **DuPont** has started to put up a $20-million facility at New Johnsonville, Tenn (its sixth in the state). It'll manufacture titanium dioxide. Long-term equipment modernizing and replacement program is underway at the company's cellophane plant at Old Hickory; this'll require four or five years for completion, will increase productive capacity by 10-million lb . . . **Nashville Machine & Supply Co,** Nashville, Tenn, is putting up a $200,000 machine shop . . . **Lebanon Products Co,** Lebanon, Tenn, manufacturer of wire display racks, is expanding its facilities with a 12,500-sq-ft addition . . . **Ferro Corp** is completing a $400,000 addition to its Nashville fiber glass plant.

Midwest...

Midwest periscope . . .
Louis E Wolfson, head of Merritt-Chapman & Scott, has added another 110,000 shares of **American Motors** stock to his previous holdings which now add up to 350,000 shares. He states that no merger is planned, but feels that American Motors needs "some overhauling" . . . **General Motors** sales for January and February are estimated to be 15% below the same period last year. Cadillac Division sales reached a new high of 5.7% above the first two months of '56, but Chevrolet's indicated volume was off 12% and Buick's 20% . . . **International Harvester** will mark its fiftieth anniversary of motor truck manufacture this year. Company turned out 73 high-wheel jobs in 1907, since then has built 2,610,000 trucks in five assembly plants . . . **Algonquin Tool & Manufacturing Co,** Chicago, is liquidating its assets, will sell its toolroom equipment individually, without an auction . . . **Teletype Corp,** subsidiary of **Western Electric Co,** plans to build a multi-million-dollar plant, research center, and office building on a 105-acre tract located partly in Niles and partly in Skokie on Chicago's Northwest side . . . **Studebaker-Packard** had an operating loss of $43.3 million in 1956 before special charges of another $60 million, according to company's preliminary report. Special charges consist mainly of reserves set up to cover costs of consolidating all car manufacturing operations in South Bend, and to provide for depreciation of plants and inventories . . . **National Cash Register Co** is going into the electronic data processing field. First production model, scheduled for completion in two years, will sell in the medium price range. **General Electric** will make the electronic computing elements at facilities to be expanded in Phoenix, Ariz; **National** will manufacture the electromechanical parts and construct the completed system . . . **Ford Motor Co's** new Edsels will be built at six plants around the country. One, at Somerville, Mass, will be converted to fulltime production of the top two series, labeled Corsair and Citation. Cars will also be turned out at facilities in Mahwah, NJ; Wayne, Mich; Louisville, Ky; Milpitas, Calif; and a plant in the Los Angeles area . . . **General Electric** is buying **Electric Auto-Lite Co's** 3,300,000-sq-ft manufacturing plant in Evendale, Ohio. Buildings are adjacent to **GE's** aircraft gas turbine division . . . Assets of **Pressed Metals of America, Inc,** Port Huron, Mich, auto parts concern, have been sold to a group headed by John D Leighton, former president of the company . . . **Chrysler Corp** is getting a $381,653,000 refund from the government based on double taxation on oil in new automobiles. US Court of Claims ruled that if part of the article sold had already been taxed, it's illegal to levy a tax measured by the sales price of the entire article . . . **De Soto** has returned to the taxicab business after an absence of two years. It'll turn out two models, a six and an eight cylinder, both four-door sedans.



Westinghouse's 50-ft Precision Lathe
At work refinishing the shaft of a 104-ton double-armature built in 1916 for a rolling mill is Westinghouse Electric Corp's new 50-ft-long lathe, which can handle work up to 15 ft in dia. On this particular job, the lathe trimmed less than ten-thousandths of an inch of metal from the shaft, allowing it to be set in its original bearings without costly modifications

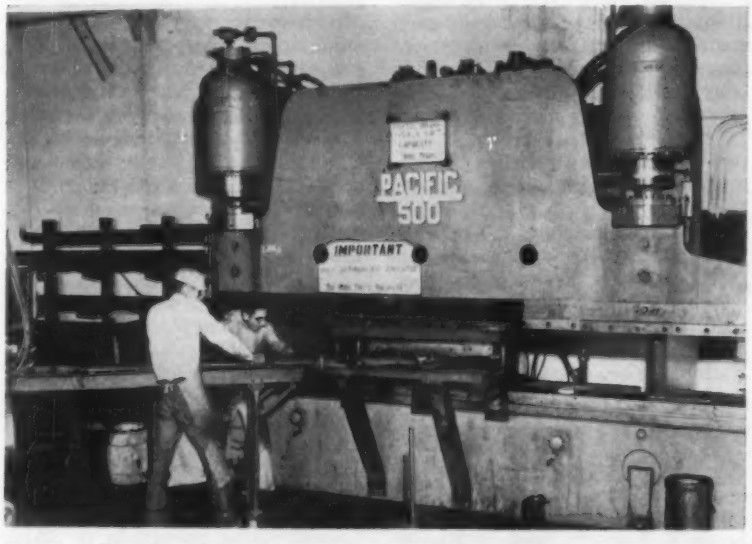
FIELD REPORT

East...

Eastern notes . . .
Underwood Corp and **National Cash Register Co** are in the preliminary stages of merger talk. If it goes through, resulting company would have total sales of some $425 million, second only to IBM in the office equipment industry . . . **US Steel Co** has closed down four furnaces mainly because of "weakness" in demand for cold-rolled sheets used in automobile production. March tonnages for Detroit are down from February, April is bringing further cuts . . . Plans have blown up for merger of **Glen Alden Corp** and **Maremont Automotive Products,** Chicago auto parts maker. After hectic, month-long negotiations, both firms agreed to drop the whole idea . . . **Westinghouse Electric's** plant at Lester, Penna, has a $8,170,060 Navy contract to make the main steam propulsion machinery for a nuclear-powered aircraft carrier . . . And **General Electric's** Lynn, Mass, facility received an $11,376,315 order to supply propulsion machinery and gears for five atomic-powered submarines to be constructed at Mare Island Naval Shipyard . . . **Penn-Texas Corp** has bought an additional 35,000 shares of **Fairbanks, Morse & Co** common stock, increasing its holdings to 48.7%, "sufficient to win working control of **F-M,**" according to Penn-Texas President Leopold D Silberstein.

West...

Around the West . . .
Boeing Airplane Co will set up manufacturing and office facilities for its Bomarc guided missile project in a $21-million developmental center now going up near its Seattle plant . . . **Solar Aircraft** has received orders totaling $12.2 million for J-57 turbojet engine components. They'll be turned out in San Diego and in Des Moines, where the factory has been expanded 25% to accommodate additional work . . . **Ford Motor Co** assembly plant at Milpitas, Calif, recently set a record for the number of vehicles turned out by a single shift. Workers put in an extra two hours, assembled 740 passenger cars and trucks instead of the usual 575 . . . The Queen Bee, an all-metal light airplane being manufactured by **Bee Aviation Association, Inc,** in San Diego, will be test flown in the fall. Four-place ship cruises at 150 mph, is expected to sell for around $12,000 . . . **Yuba Manufacturing Co,** San Francisco maker of material handling equipment and fabricated steel items, has acquired **Adsco Industries, Inc,** (heat exchangers and expansion joints). Company's plants at Richmond, Calif, and Buffalo, NY, will be operated out of San Francisco as divisions of Yuba . . . **Food Machinery & Chemical Corp,** San Jose, has a $1,225,000 contract for manufacturing machine gun cupolas. Equipment will be installed on M59 and M84 tracked vehicles manufactured by FMC for the army . . . **Convair Division** of **General Dynamics** has sold four 880 jet transports to Transcontinental, SA, a newly certified Argentina airline . . . **Ryan Aeronautical Co,** San Diego, has a new AF contract in excess of $10 million for several hundred additional Firebee jet target drones . . . **Western Electric Co** is going to build a $35-million plant on a 210-acre site in Oklahoma City. It'll turn out automatic switching equipment for the telephone industry, and will need 3500 to 4000 workers . . . **Boeing Airplane** says it's not aware of any consideration being given by the government to phasing out the B-52 program prior to completion of a total of 603 planes, which would take several years for delivery . . . **Hiller Helicopters,** Palo Alto, plans to concentrate on three types of vertical take-off craft—helicopters, ducted fan aircraft, and tilt-wing propelloplanes. Company is currently working on the XROE-1 Rotorcycle, a one-man collapsible helicopter . . . **Kaiser Steel Corp,** Oakland, Calif, which has a $113-million expansion program under way, is negotiating for private placement of securities to help raise another $81 million. Total program, which would boost rated capacity 91%, calls for a fourth blast furnace, coke ovens, a third oxygen furnace, and modification of the plate mill . . . **Griffith Wheel Co** has begun production of steel wheels at its new million-dollar, 20-acre plant site in Colton, Calif. Pressure pouring method involves forcing molten metal into permanent graphite molds under air pressure . . . **Lear, Inc,** Santa Monica, has a $3.9-million AF contract covering automatic flight control systems, spare parts, special tools and data for the Boeing KC-135 jet tanker-transport . . . **Standard Pressed Steel's** new $5-million plant in Santa Ana, Calif, scheduled for May opening, will employ approximately 500 workers to turn out company's shop equipment line and aircraft parts.



Press Brake Shears 1-in. Steel Plate

Making a press brake with a $6000 shearing attachment do the work performed by shears costing up to $90,000, a farm machinery manufacturing firm here shears 1-in. high-carbon steel plate. Attachment can do production shearing of plate up to 1½ in. thick, and 3 ft long. It's made by Pacific Industrial Manufacturing Co

J C Drader, vice president of Michigan Tool Co, has been named to the new post of vice president, research

M A Hayden, general manager of the Waterbury Tool Division of Vickers Inc, has been appointed general manager of the new Machinery Hydraulics Division

Revis L Stephenson has been appointed executive vice president of US Hoffman Machinery Corp. He will continue as director of foreign and export operations, and as supervisor of the Industrial Divisions

Names in the News . . .

Robert J Dubuc has been named manufacturing manager of Gear Grinding Machine Co, Detroit.

Leonard H Skoglund, Jr, vice president of Scully-Jones & Co, has been elected president of the Cutting Tool Manufacturers Association.

W T Thornton, Jr, has been elected a vice president of the Wayne Pump Co, Salisbury, Md.

Sydney A Skillman has been elected vice president and named general sales manager of Studebaker-Packard Corp. He moves up from the post of assistant general sales manager.

W F Driver has been named general sales manager of the Machinery Hydraulics Division of Vickers Inc, Detroit. He formerly managed the industrial products sales dept, which has become part of the new division.

William J Laughlin, Los Angeles branch manager of Thor Power Tool Co, has been appointed to the new post of industrial division manager; he will supervise sales of all Thor air and high-frequency electric tools.

Frederick M Jackson has been named vice president, sales, for Walworth Co, New York. He has been serving as vice president in charge of oil and gas industry sales. **Ardon B Judd** executive vice president of Southwest Fabricating & Welding Co, Houston, Texas, subsidiary, has been elected president of that company.

E J Reitler has been promoted from assistant sales manager of Firth-Loach Metals, McKeesport, Penna, to sales manager.

L F Van Nortwick, sales manager of the Frostrode Division of Progressive Welder Sales Co, Detroit, has been named general sales manager of the company. **Irving L Pond** takes over Mr Van Nortwick's former post.

A R Schneller has been named sales manager of welding products and accessories for the Welding Products Division of A O Smith Corp, Milwaukee. His previous post as eastern regional sales manager has been taken over by **D H Buerkel,** formerly sales representative in the Philadelphia area.

Edwin H Walker has been elected president and general manager of General Motors of Canada, Ltd. He succeeds **William A Wecker,** who is retiring. Mr Walker was formerly president and general manager of McKinnon Industries, Ltd, of St Catherines, Ont, a GM subsidiary. **E Jack Barbeau,** factory manager, succeeds Mr Walker.

Kenneth Ode has been named vice president and general manager of Midland Steel Products Co's Cleveland Division. He was formerly associated with White Motor Co as general manager of its Special Products Division. **Warren MacFarlane, Jr,** previously vice president, manufacturing, for Minneapolis-Moline, has joined Midland as vice president and general manager of the Detroit Division. **Charles Whitney** is new division manager of the company's Detroit operation. Prior to his appointment he was plant manager of Ford Motor Co's frame and cold heading plant.

Robert E McKee has been appointed training director of R K LeBlond Machine Tool Co, Cincinnati. He was formerly associate professor of mechanical engineering at the University of Michigan.

C E Reid, assistant works manager of Republic Aviation Corp, Farmingdale, NY, has been named works manager in charge of the company's plants on Long Island.

John R McDonald has been promoted to manager of small screw sales for Lamson & Sessions Co, Cleveland. He was formerly assistant manager of the division. **Robert G Patterson, Jr,** has been made manager of distributor sales for the company.

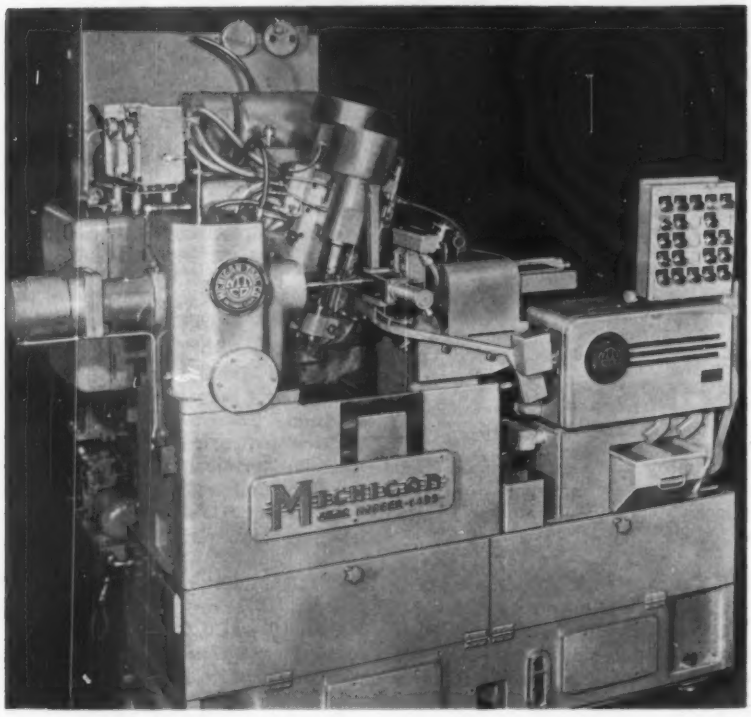
Centre W Holmberg, Jr, has been elected vice president, sales, of August W Holmberg & Co, Flushing, NY, manufacturer of precision tools and dies. He moves up from the post of sales manager.

OBITUARIES

Albert W Miller, 53, founder and board chairman of Portable Electric Tools, Inc, Chicago, died March 5.

Reuben J Russell, 81, vice president and founder of Century Electric Co, St Louis, Mo, died Feb 11.

New Shop Equipment



Gear Hobber Adapts to Tandem Or Series Setup

Model 1433 Ultra-Speed gear hobber, latest addition to Ultra-Speed line, is easily adapted to any degree of automation. Using a common sub-base, the machines can be set up in tandem or unlimited series with automatic through-feeding and removal of parts. Gear washers and classifiers can be integrated into the machine units. Automatic size control is also provided.

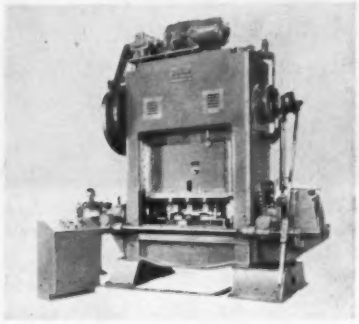
All machine services are self-contained in sub-base, including air or hydraulic pressure lines for operation of feeds, coolant system or coolant piping for addition to central system, conveyor for removing chips, used-coolant return lines, conveyor lines to remove finished parts, and central system lubrication lines. Master panel and electrical connections are mounted in sub-base, so that hobbing unit can be removed from sub-base without disrupting in-line gear production.

Unit retains many features of previous models, including the plunge cutter feed and automatic expansion arbor. Machine will hob up to 12-pitch spur or helical gears. Max center distance—hob arbor to work spindle is 3¼ in. Max crossfeed stroke of hob is 4 in. Either RH or LH helix angles up to 30° can be hobbed.

Hob is plunge fed into work, then fed across the work, the stroke being completely adjustable. Plunge infeed and crossfeed are infinitely adjustable. Work rotation is by preset timed relationship with hob.

Entire hobbing cycle is automatic. Hobs revolve at speeds up to 500 rpm, and either conventional or climb hobbing may be used with single, double or triple thread hobs. Three separate adjustments may be made to the hob head: hob thread angle, gear helix and automatic hob position shift.

Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich

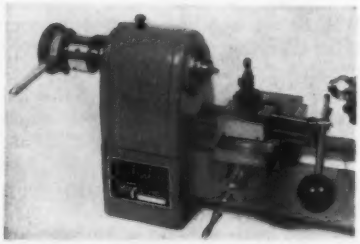


High-Speed Press Produces Up to 250 Strokes Per Minute

200-ton Flexopress, equipped with air-friction clutch and scrap cutter, is designed to run at speeds up to 250 spm. Slide, fitted with four preloaded ball-bearing raceways, provides high degree of vertical accuracy: bottom of ram is parallel to bed within 0.0005 in.

Unit features double feed rolls mounted integrally for accurate stock feed. It has an all-steel frame, welded and keyed with four tie-rods. Powered by a 25-hp variable-speed motor, this high-speed press features console control.

Precision Welder & Flexopress Corp, 3520 Ibsen Ave, Cincinnati 9, Ohio

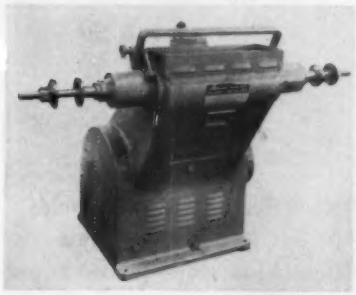


Derbyshire Adds Collet Closer To Tool and Accessory Line

Hand-Quick collet closer can be used on cone-bearing or ball-bearing lathes. Shown mounted on company's Model 750 lathe, it also fits other models, including the Webster-Whitcomb, Magnus and Elect. The lathe operator reportedly can adjust collet tension very quickly and change collets easily.

F W Derbyshire, Inc, Waltham, Mass

Materials and Parts . . .



Polishing and Buffing Lathe Has Special Braking Bar

Model VRO variable speed polishing and buffing lathe now features a braking bar that can be actuated from either side of the machine. Machine is a heavy-duty model suited to polishing, brushing or buffing operations. Spindle speed, infinitely adjustable between 1500 and 3000 rpm, is changed by turning speed dial mounted on top of machine. Advantages claimed for unit include choice of efficient spindle speed for given operation, and wheel economy—as brushes and buffs wear down, spindle speed is increased to maintain correct peripheral speed.

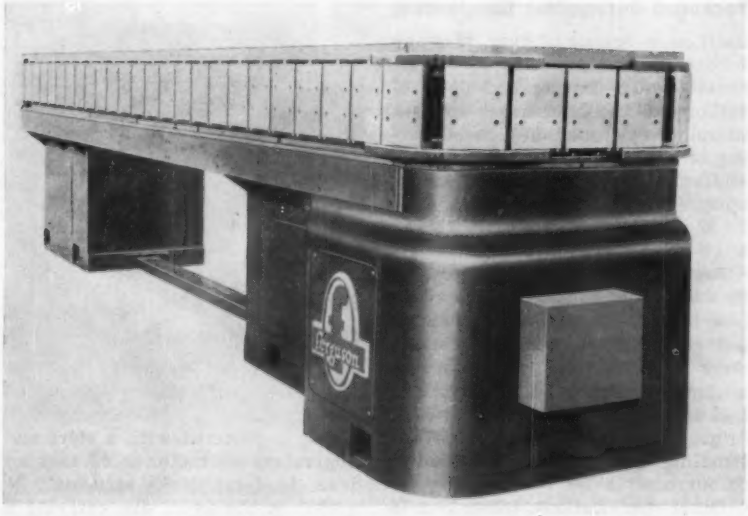
Hammond Machinery Builders, Inc, 1618 Douglas Ave, Kalamazoo, Mich

Strips, Bars, Tubes Made From Metal Powder by New Process

Process known as Sinterwrought reportedly can produce symmetrical shapes such as strips, bars, rods, wires, foil and tubes, from metal powders. Products are said to have greater strength and ductility than conventional metal powder products, and do not contain the impurities present in cast billets from which common wrought material is made.

Critical metallic or non-metallic ingredients can be added to the composition in a more uniform dispersion than possible by melting. Metals handled by the process include aluminum, copper, nickel, cobalt, carbon steel, stainless steel, and alloys of these metals. Sinterwrought strip is already available in lengths of 20 ft or more.

Sintercast Corp of America, Yonkers, NY



STRAIGHT LINE TRANSFER MACHINES are now available with strokes of either 6, 8, 12, 16, or 24 in. and with a choice of two types of carriers in various sizes. Standard lengths are 10, 14, and 18 ft. Base alone is provided, tooling is added by user—unless complete machine is desired. Control panel has interlock feature as well as start, stop and jog controls. Drive employs modified trapezoid acceleration characteristic—*Ferguson Machine Corp, Roller Gear Div, P O Box 5841, St Louis 21, Mo*

...including

MACHINE TOOLS AND ATTACHMENTS

Horizontal Honing Machine 190
Contour Grinder 191
Vertical Boring Mill 191
Vertical Shaper 194
Gear Hobber 198
Turret Lathe 202
Cutoff Saw 225

TOOLS AND ACCESSORIES

Right-Angle Nutsetter 190
Relief Grinding Fixture 204
Solid Carbide Routers 232

FORMING AND FORGING

Plastic Molder 196
Hand Press 204
Gap Press 206

WELDING

Bench-Type Welder 190
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CLEANING AND FINISHING

Ultrasonic Transducer 200
Titanium Descaling Process 204
Buffing and Deburring Process 204
Abrasive Cleaning Machine 220

INSPECTION AND LAYOUT

Electronic Air Cleaner 192
Surface Inspection Unit 194
Temperature Controller 202
Indicating Gages 212

PLANT SERVICE EQUIPMENT

Rotary Storage and Feeding Unit 190
Fork-Lift Truck 202

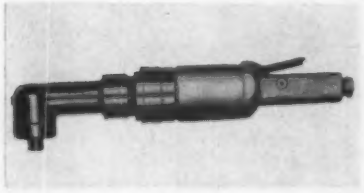
Rotary Storage Unit Provides Demand-Feeding System

High-capacity storage unit for parts or blanks that can roll is designed for use in automated processing lines. Each unit is custom-tailored for a specific job and assembled from standard components. Rotary form is provided in circular or oval shape to suit particular floor requirements. Operation is all pneumatic to insure trouble-free life.

In operation, parts are guided through a silhouette "accept-reject" device to caged double threads (or tracks) and gravity fed to the elevator, which works off a stroke-lift pneumatic piston. As parts leave elevator at the top of the equipment, they are gravity rolled through circular tracks to the exit chute takeoff. Parts can be positioned vertically or horizontally for the following machine operation. Air-cylinder-operated gates in the tracks control movement of the parts on demand.

When used for stockpiling parts, equipment automatically stops when full capacity has been reached. This is accomplished by using the static weight of the parts to move mechanically air valves that cause the gates to open or close.

Michigan Tool Co, Gear-O-Mation Div, 7173 E McNichols Rd, Detroit 12, Mich



Thor Right-Angle Nutsetters Offered in Six New Models

Right-angle nutsetters in capacities up to ½-in. bolt size are part of company's No. 4 series of industrial air tools, and are offered in six models and two types: No. 4RDC heavy-duty type in speeds of 350, 600, 1100, and 1300 rpm and No. 4RDXC model in speeds of 800 and 1350 rpm. Latter two models are equipped with smaller proportioned right-angle attachments for use in close quarters.

Cylinder housing is aluminum alloy casting with straight throttle handle. Motor is 5-blade type with alloy-steel one-piece rotor and shaft. Gear case has lengthwise slots at 90° intervals into which angle type nutsetting attachments are keyed.

Thor Power Tool Co, Aurora, Ill

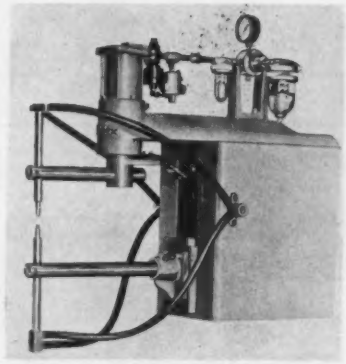
Microhoner Is Designed to Accept Packaged Automation Components

Built as a horizontal-type machine with a stationary bridge to accommodate work fixtures and optional equipment, the Micromatic 150 has its spindle mounted on a reciprocating carriage, hydraulically actuated, while the adjusting head is manually operated. The machine is 34 in. wide by 52 in. long, has a 12-in. stroke and a 1½-in.-dia capacity.

Basic machine can be automated by addition of packaged units available from company. Units include an automatic hydraulic feed and stone-wear compensator; an automatic coolant separator, pump and tank; and an automatic sizing unit of either gage plug or gage ring type. Work handling devices can be designed to fit machine.

Other specifications: table, 17 x 16 in.; variable speed drive for spindle; reciprocating speed range of 0 to 60 sfpm; 5-in. distance between centerline of spindle and surface of table; approx weight, 3500 lb.

Micromatic Hone Corp, 8100 Schoolcraft Ave, Detroit 38, Mich



Weldex Bench-Type Units Weld Light and Non-Ferrous Metals

Two bench-type air-operated 5- and 10-kva spot or projection welders are designed for welding light and non-ferrous metals, and feature valve and speed controls mounted at the cylinder, and a ram bearing surface of 15 sq in. at full stroke. When horns are used, the greater bearing surface gives more rigidity and reduces tip skidding.

Welders are water-cooled and the transformers have four heats. No. 1 Morse taper electrodes are used and the lower bracket has a 4-in. vertical adjustment. Cylinders are 2½ or 3 in. with a 2-in. stroke.

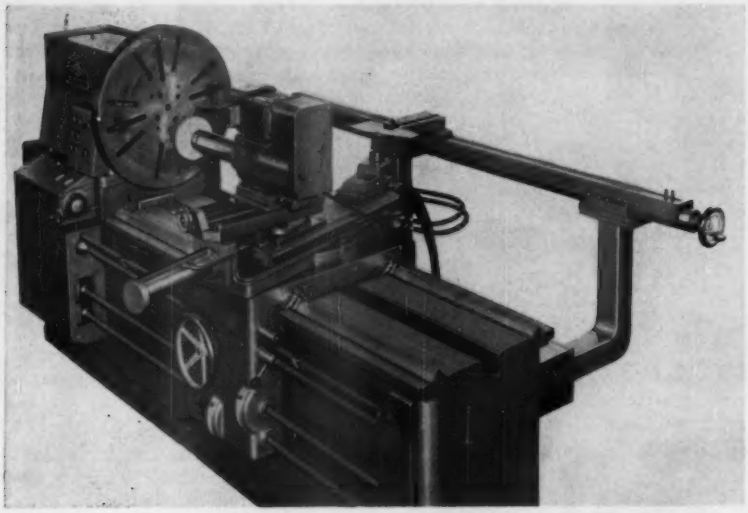
Weldex, Inc, 18404 Weaver St, Detroit 28, Mich

Geneva Index Table Has 16-36 Stations

Series PDC-AM24 has a 24-in.-dia dial plate, can handle plates up to 36 in. in dia.

Unit is powered with a start and stop rotary air motor drive that indexes in 1 sec, locks accurately to ±0.001 at the 24-in. dia, carrying a load of 1000 lb. It is furnished with rotary air motor, limit switch, solenoid valve, airline filter, oiler, and covered box with three interlocking control relays.

Precision Detroit Co, 20100 Sherwood Ave, Detroit 34, Mich

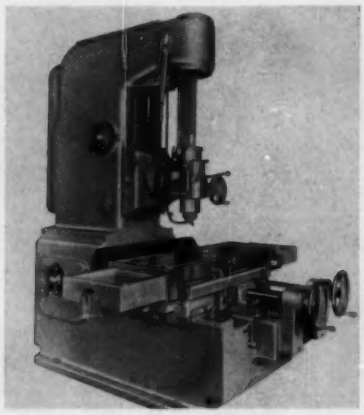


Three Angularity Adjustments Add Flexibility to Contour Grinder

Tracer-controlled hydraulic contour grinder has three angularity adjustments in a single swivelling or pivoting unit. A swivelling grinder spindle which will swing in 180° arc is mounted on tracer slide; tracer slide is mounted turret-wise on carriage and is free to swivel 110° with tracer stylus; tracer stylus also swivels 180° and is mounted on end of tracer slide. This arrangement reportedly permits precise contact pressure between tracer stylus and the templet.

Grinding of both internal and external contours is possible on this machine which uses standard flat wheels dressed to simple radiuses. Head stock range is from center to 39 in. on OD work; bed of machine is 121¾ in. long and 24 in. wide. Grinder spindle accepts 1¼-in.-dia bore and from 3½- to 8-in.-dia grinding wheels. Machine offers work head speeds from 0 to 220 rpm and a grinder head speed of 3450 rpm. Variable-speed work head allows machine to be used for polishing and buffing.

Industrial Tool Engineering Co, 13849 Keal, Detroit, Mich

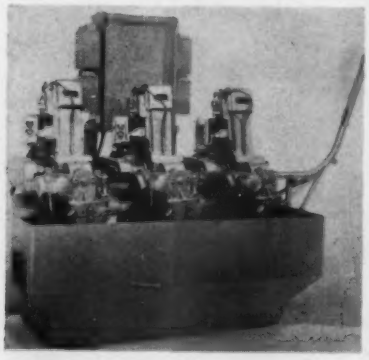


Knight Boring Mills Have 30-in. Vertical Capacity

No. 60 vertical machine for precision boring and milling is built in two sizes, each of which has a vertical capacity of 30 in. The smaller unit, with 18 x 52-in. bed-type table, has 18-in. cross travel and 28-in. longitudinal travel. Larger unit has an 18 x 60-in. table, with 18-in. cross and 36-in. longitudinal travel.

Wide, fixed bed is equipped with 3-way bearings for maximum rigidity. Spindle and spindle head are counterbalanced for smooth operation. Time-saving features include quick-change tooling for the spindle, together with table and saddle-locating counters.

W B Knight Machinery Co, Vandeventer & W Pine Blvds, St Louis 8, Mo



Grinder Combines Three Operations In Single Automatic Sequence

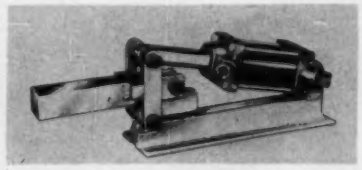
Typical grinding sequence on Engelberg Model L4-3, using series of progressively finer-grit abrasive belts, is rough grind, finish grind, and fine polish. Designed for high-speed volume production on ferrous, non-ferrous, plastic, glass and other materials, this wet-or-dry belt centerless grinder accommodates stock from 3/32 to 2¾ in. in dia, any length, and maintains tolerances of .001 in. or less, at through-feed rates up to 35 fpm. Small cylindrical parts can be hopper-fed.

Through-feed rates are controlled by adjustable helix angle of regulating wheel, in combination with change gears which drive regulating wheels at different rpm. Belt speed is 5000 sfm, and abrasive belts, 4x54 in., can be changed rapidly.

Other specifications: individual drive units for grinding heads, 3 or 5 hp; regulating wheel drives, 1/15 hp; over-all machine dimensions, exclusive of electrical control box, 66 x 35 x 55 in. high.

Self-contained coolant system applies coolant to grinding area and also jet-sprays abrasive belt to prevent belt loading.

Engelberg Huller Co, 831 W Fayette St, Syracuse 4, NY



Heavy-Duty Clamps Added to Lapeer Line

Hand clamp is available in four models with either a solid bar (Models VS-200HD and VS-400HD) or channel bar (Models V-200HD and V-400HD) of cold rolled steel with clamping pressures of either 200 or 400 lb.

Air (or oil) operated clamps, Models AOS-200HD and AOS-400HD have solid bars for demanding applications of automation. Air can be supplied from right or left by rotating clamp cylinder. Failure of air or oil pressure reportedly will not release the clamp.

Lapeer Manufacturing Co, 3042 Davison Rd, Lapeer, Mich

Automatic Cross-Drilling Machine Has Four Horizontal Drill Heads

Special automatic cross-drilling machine can perform varied multiple operations using four horizontally-mounted drill heads, located on a common plane and pivoting around the axis of the workpiece through an arc of 270°. Feed movements are hydraulically powered.

A 4-position rotary drum switch controls the sequence of operation of the heads; control of heads is interlocked to prevent drill interference. Many multiple operations can be performed at high speeds. For example, heads operate in a pre-set sequence for cross-drilling, but can also operate simultaneously when holes do not intersect. Through-drilling can be performed by one head, followed immediately by reaming with opposed head. In the same cycle, the workpiece can then index 90° for counterboring and chamfering with the other two opposed heads.

Russell T Gilman, Inc, Grafton, Wis

High Temperature Drawing Process Yields Fatigue-Proof Steel

New process, named "e t d" (elevated temperature drawing), produces a steel marketed under the name Fatigue-Proof. Dimensional tolerances, surface finish and machinability usually associated with cold-finished bars reportedly have been incorporated in this steel which, it is also said, has strength properties normally developed by heat treatment. Bars have a tensile strength of 140,000 psi, yield strength of 125,000 psi, and 30 R_c hardness. It machines about 25% faster than annealed alloy steel. Further heat treatment is often eliminated.

Process depends upon three phenomena which take place as bar is deformed at elevated temperatures (between 200 F and below lower critical temperature). First, steel bar strain hardens by slip within crystal structure; second, it age hardens by precipitation of nitrides and carbon from solid solutions; and third, a substructure develops within grains as result of deformation. Close control of these processes yields desired properties. Samples are available (AM—Jan 14, '57, p163).

La Salle Steel Co, P O Box 6800-A, Chicago 80, Ill

Hyster Fork-Lift Truck Has 2000-lb Capacity

Model QX lift truck, with 2000-lb capacity on pneumatic tires, is powered by a Wisconsin 4-cylinder air-cooled engine. Truck, a redesign of an earlier announced model, can be equipped for LP-gas operation. Improved operation is reported to result from use of constant-mesh transmission and from a repositioned instrument panel.

Optional attachments include company's Load-Grab clamp, by which loads are handled by hydraulically actuated arms, and a side-shift carriage that shifts loads and speeds handling by reducing truck maneuvering time.

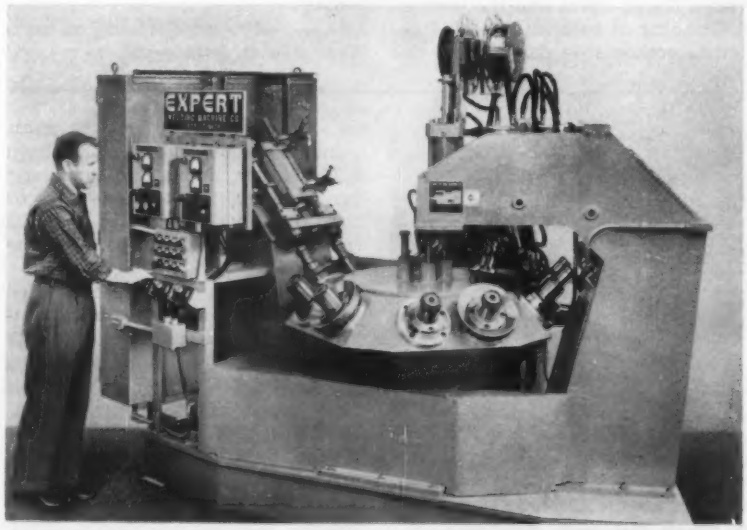
Hyster Co, 2902 NE Clackamas St, Portland 8, Ore

Electronic Air Cleaners Remove Particles As Small As .001 Micron

Electronic air cleaners, available in 1300- and 2000-cfm models, use a 13,000-v ionizer section to ionize dirt particles. Given a positive electrical charge, dust particles become positive ions which are attracted to negative (6500-volt) collector plates. After being collected, particles can be washed away by water spray. Units are said to operate at 90% efficiency in removing dirt particles down to size of .001 micron, at 333-fpm-air velocity.

Both models operate on 110v ac; the smaller unit consuming about 50 watts. Cost is approx $500 installed.

Minneapolis-Honeywell Regulator Co, 2753 Fourth Ave S, Minneapolis 8, Minn



WELDING MACHINE, 5-station rotary index type, uses automation methods to combine assembly and CO_2 shielded arc welding operations. Machine press assembles and contour welds flat circular plates to inside of cylindrical parts at a rate of 500 finished assemblies per hr, and is suitable for parts up to 5 in. in dia. Unit consists of index table, two spring-collet fixtures per station, air-operated press, two welding heads, and unloading mechanism—*Expert Welding Machine Co, Div of Expert Die & Tool Co, Inc, 17144 Mt Elliott Ave, Detroit 12, Mich*

new help for you!
Gulf Petro-engineering Service
. . . now available to all users
of petroleum products
GULF

Proper engine tune-up procedures mean maximum fuel economy in fleet operations. Gulf Sales Engineers work closely with fleet maintenance superintendents to help save fuel, lengthen periods between overhauls, and increase availability of equipment.

Gulf Petro

brings you practical involving the use of

Gulf Sales Engineers can provide practical assistance to paper mill operators on any process or problem that involves petroleum products.

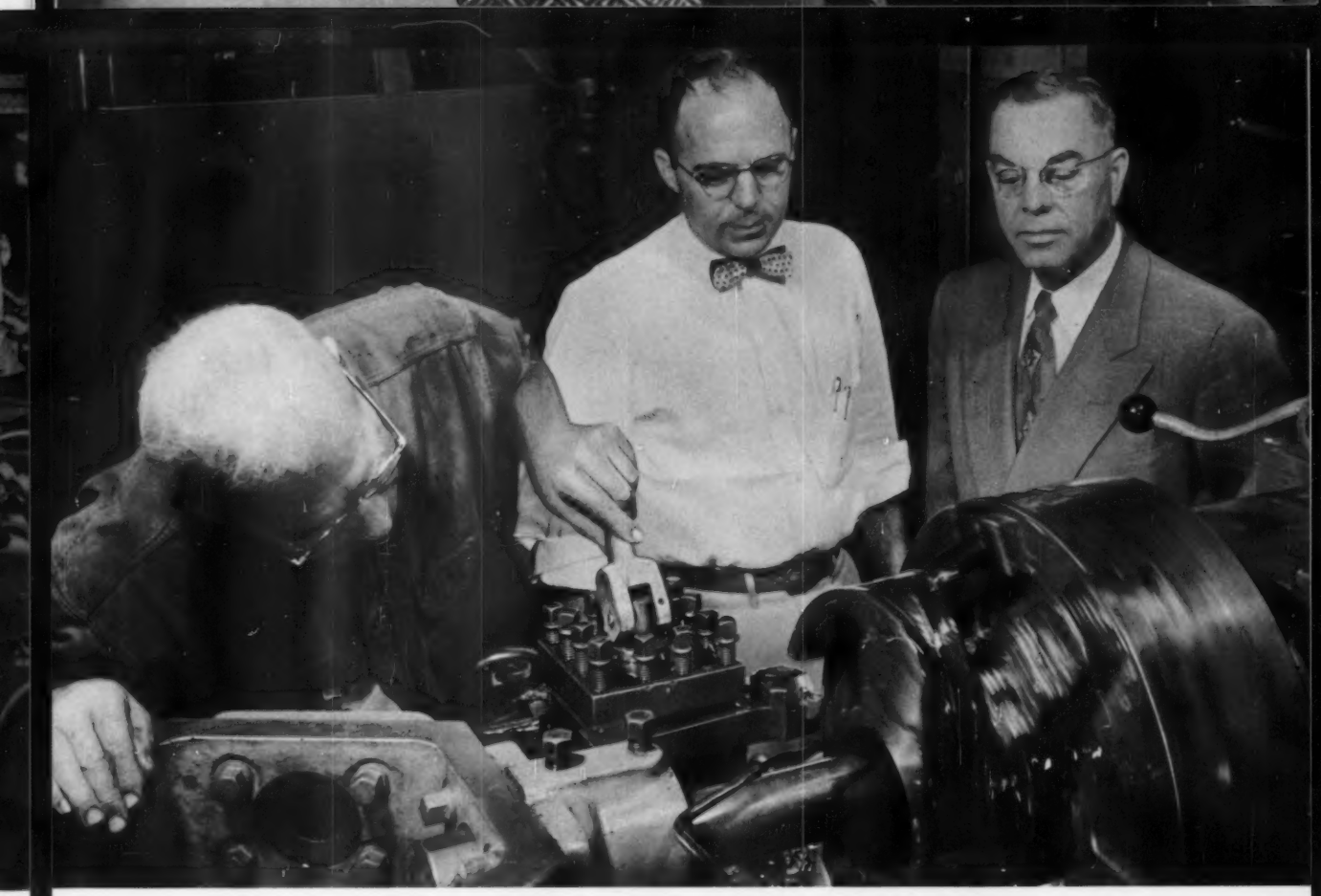
If you are engaged in manufacturing, mining or quarrying . . . construction or transportation . . . communication or public utility service—you can profit from Gulf Petro-engineering Service.

All of these fields use petroleum products. Many problems arise in connection with their use—problems of proper selection, of storage, of dispensing, of application schedules. And, most important of all, problems of equipment performance!

Very few companies, however, find it practical to hire or train qualified people to perform this specialized engineering job. Gulf offers you its own trained staff to assist you with these problems.

Gulf Petro-engineering Service puts a petroleum specialist in your plant or other base of operations to give you impartial, expert advice on any problem in any way related to the uses of petroleum products.

You can get Gulf Petro-engineering Service if you are



A Gulf Petro-engineering Service specialist can help you select the most suitable cutting fluid for each machining operation. Chances are he will find practical ways to improve production, increase tool life and lower costs.

-engineering Service

help on every problem and process petroleum products

a user of petroleum products—whether or not you have been buying those products from Gulf.

There is no charge for this service.

In essence, here's what Gulf Petro-engineering Service offers you . . .

1. Expert help with any immediate problem involving use of *any* petroleum product.
2. Practical help on any long-range problem, including those which may involve new uses or new types of petroleum products.
3. A survey of your entire operation. Aim: to help you achieve greater efficiency and economy in the use of fuels, lubricants, cutting oils, rust preventives and process oils.

Gulf has a large group of trained and experienced sales engineers ready to serve you. The typical Gulf Sales Engineer who contacts you is a graduate engineer. He has been well-schooled in the formulation and uses of petroleum products. He has the versatility and invaluable knowledge that comes through many years of practical field experience.

If yours is a highly involved or difficult problem, he can enlist the help of another specialist—a Gulf Product Application Engineer.

Behind Gulf field representatives are more than 1,300 scientists, engineers, metallurgists and chemists at Gulf laboratories specializing in the manufacture and application of petroleum products. Their knowledge, coupled with the experience of field engineers, adds up to a broader, better service than has ever been offered before to industrial and commercial users of petroleum products.

Take advantage of Gulf's Petro-engineering Service now. Use the coupon on the next page to send for booklet describing the complete service—or write or call your nearest Gulf office.

For over 50 years, leading manufacturers in all

Gulf Petro-engineering Service

can be put to work for you immediately on any or all of these problems. It can help you . . .

- Plan the installation of more efficient fuel and lubricant storage and dispensing facilities.
- Get maximum fuel economy through proper engine tune-up procedures.
- Obtain maximum heat or power from each gallon of fuel oil through more efficient combustion.
- Establish proper oil change periods.
- Cut maintenance costs through improved application of lubricants.
- Select rust preventives according to the exact kinds of protection you need.
- Eliminate or reduce oil vapors, sludge deposits and corrosion of fuel oil storage tanks.
- Reduce the number and variety of lubricants used.
- Establish proper flushing procedures for both old and new equipment.
- Control dust on plant grounds and parking lots.

If you are faced with any of these common problems—or with any problems involving petroleum products in use—simply call your nearest Gulf District Office.

GULF OIL CORPORATION
Gulf Building, Pittsburgh 30, Pa.

☐ Send free Gulf Petro-engineering Service booklet.
☐ Have a Gulf Sales Engineer call.

Name_____ Title_____

Company_____

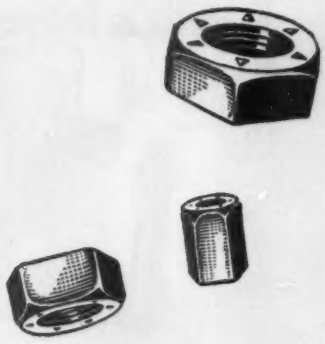
Street_____

City_____ Zone_____ State_____

GULF

GULF OIL CORPORATION
Pittsburgh 30, Pa.

SP-8934



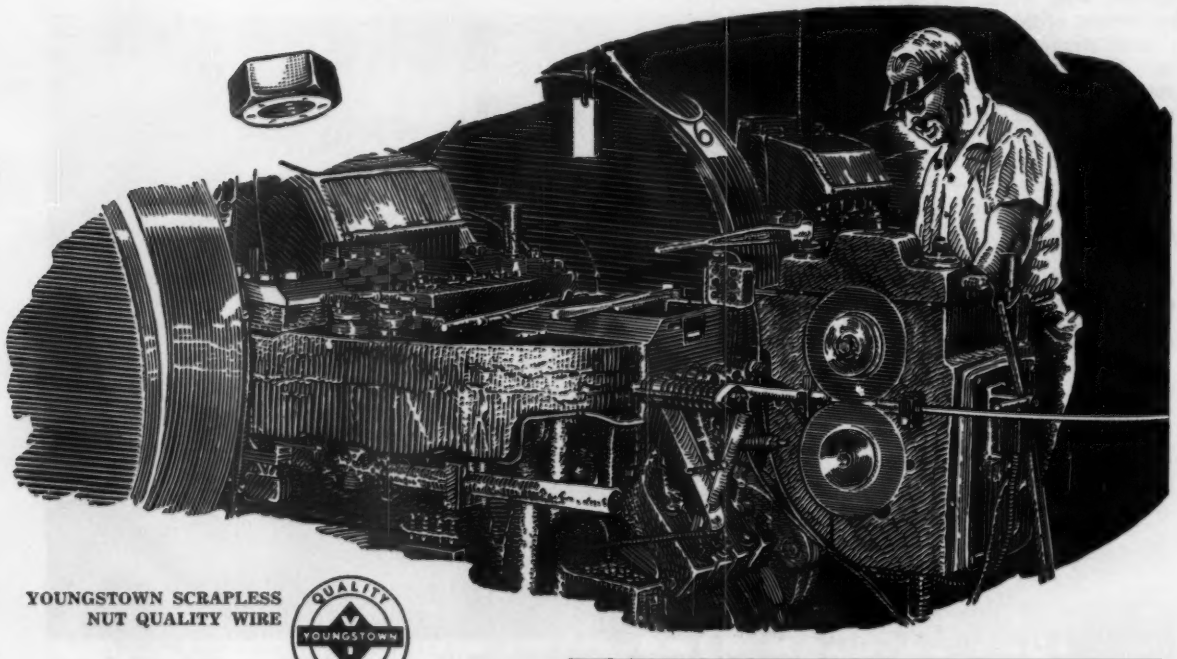
For over 50 years, leading manufacturers in all the major industries have used Gripco lock nuts to simplify production, lower manufacturing and maintenance costs and to improve the durability of all kinds of assembled products. To maintain this enviable reputation for outstanding product quality, the Grip Nut Company of South Whitley, Indiana, uses quality-controlled Youngstown Scrapless Nut Wire and Bars as basic raw material.

Because it comes to your plant free from all piping, injurious seams, laps, die marks, internal tearing and cupping, and non-metallic inclusions —Youngstown Scrapless Nut Quality Wire will provide increased production with fewer rejects which adds up to a healthy over-all profit boost. Also, its smooth coating extends die life thus minimizing costly die replacements.

YOUNGSTOWN SCRAPLESS NUT WIRE

Helps Maintain Quality of GRIP *Lock Nuts*

Youngstown Scrapless Nut Quality Wire is provided in special resulphurized steels as well as in standard AISI grades. Cold Heading Bolt Wire, of the same high Youngstown quality, is also available in all standard carbon and alloy analyses. Why not phone or write to our nearest District Sales Office for additional information or metallurgical assistance?



YOUNGSTOWN SCRAPLESS NUT QUALITY WIRE

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio

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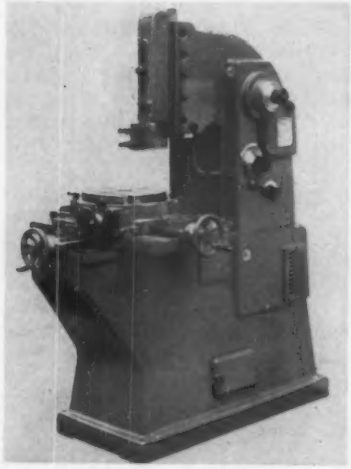
SP-8934



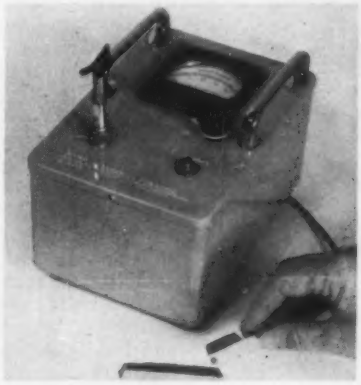
French-Made Vertical Shaper Has Built-In Rotary Table

The Chomienne 5-in. vertical shaper, a product of France, is designed for toolroom work and for short production runs of parts requiring machining of regular or irregular internal or external contours in a single setup. Machine provides 11½-in. longitudinal and transverse carriage movements, plus rotary movement through the built-in 12½-in. rotary table. Lateral movements are obtained by handwheel-operated leadscrews, with worm and worm-gear movement of the rotary table.

Ram stroke is adjustable up to 5 in. Accelerated ram speed on the return stroke is obtained by a rocker arm in the ram drive. Machine is driven through multiple V-belt drive from a 2-hp motor enclosed in the base. Motor also drives an oil pump which automatically lubricates all moving parts.

All controls for selection of speeds, strokes, and feeds are centralized and within easy reach of operator.

Imported by Austin Industrial Corp, 76 Mamaroneck Ave, White Plains, NY

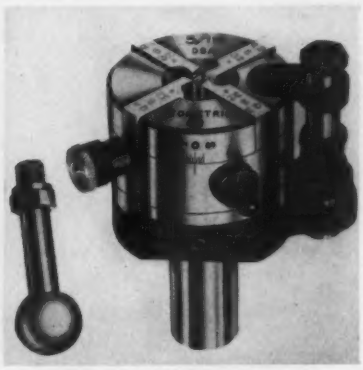


Surface Inspection Unit For Flats, Rounds, or Holes

Electronic instrument, called Micro Surfit, determines surface finish in micro-inches by comparison or by direct measurement.

As probe is stroked across surface under test, a fine-radius sapphire stylus translates minute irregularities into an electrical signal which is amplified, corrected, and indicated on the meter, calibrated in micro-inches. Unit has readings from 0 to 50, 0 to 100, and 0 to 150 mu-in.

Saratoga Scientific Co, Box 488 Saratoga, Calif



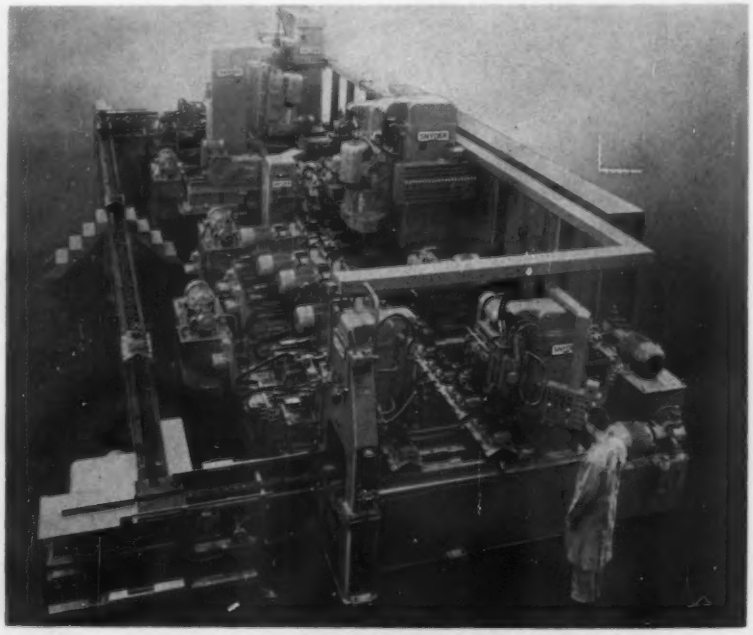
Convertible Self-Opening Die Head for Small Screw Machines

Designed for use on small screw machines, model DSA die head with aligning shank is equipped with both an outside trip for short-length, fine-pitch shoulder threading and a pull-off trip for longer threads, providing ample chaser engagement for tripping.

Other features include ease of assembly, smooth operation, improved locking bolt, heavier tripping mechanism. Present DS chasers interchange in new model.

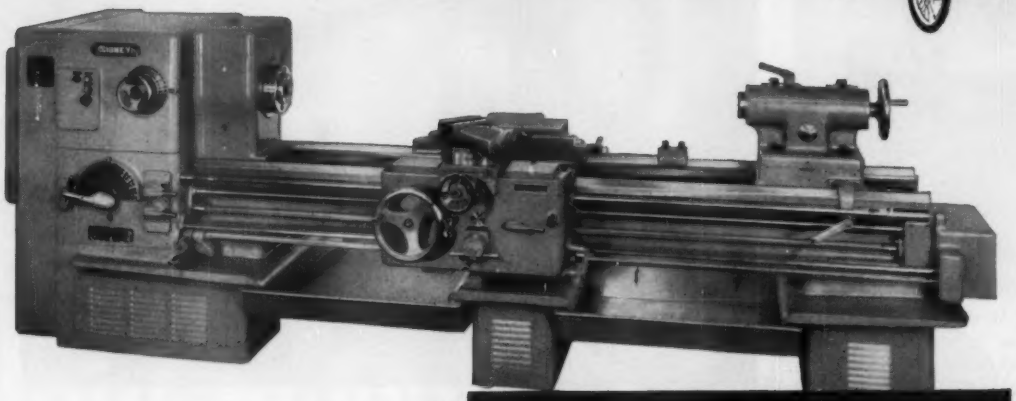
Geometric Tool Co Div, Greenfield Tap & Die Corp, New Haven 15, Conn

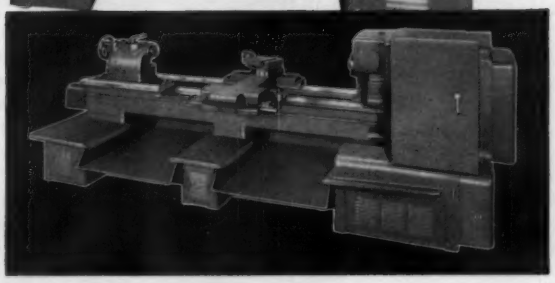
BORING BAR, using Kendex triangular button inserts, comes in sizes ranging from 1⅛ to 2½-in. shank diameter. Carbide inserts are available in ⅜ and ½-in. inscribed circle sizes—*Kennametal Inc, Latrobe, Penna*



FORGED STEEL STEERING KNUCKLES are milled, hollow milled, drilled, spotfaced, tapped and reamed on 60-ft long, 26-station segmented palletized transfer machine at a net rate of 146 pieces per hr. Two parts at a time are clamped in pallet-type fixtures in this hydraulically-operated, electrically-controlled unit —*Snyder Tool & Engineering Co, 3400 E Lafayette, Detroit 7, Mich*

Your Present Lathes may be Older than you think!





Date of purchase doesn't tell enough —some lathes grow older and weaker sooner than others . . . your costs go up as efficiency and production fall lower and lower. You can't expect old-timers to keep up today's swift pace! The remedy is simple . . . the results are astounding . . . and now is the time to face up to the facts.

SIDNEY DIAL-MASTER MODEL 32 LATHES

stay young, vigorous and more productive longer.

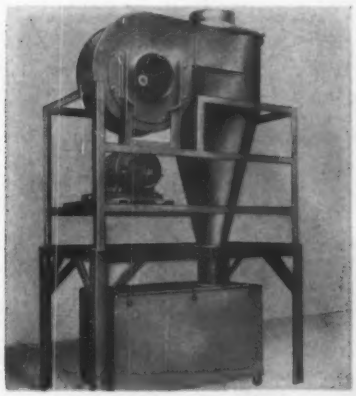
These lathes are designed and constructed to occupy a minimum of floor space so they can be integrated for convenience and efficiency into your plant layout.

Note these Features:

- **HEAD STOCK WITH HERRING-BONE GEARS** provide smooth operation, greater strength and elimination of end thrust thru the double opposed 30° helix angle. Constant flow of power. Filtered automatic forced feed lubrication.
- **32 PRE-SELECTIVE SPINDLE SPEEDS** obtained by rotating dial control. Shift from speed to speed in a lightning-like TWO SECONDS.
- **SINGLE LEVER CONTROL ON CARRIAGE AND APRON** actuates positive serrated jaw plates incorporating all four directions of feed and rapid traverse operating from one control head. All gears (except rack pinion) are enclosed. Automatic lubrication.
- **BED DESIGN UNUSUALLY STRONG AND VIBRATION FREE** with greater bearing area to take downward thrust and greater resistance to deflection and twisting. Superior to conventional two-wall construction.
- **TOTALLY ENCLOSED GEAR BOX** powered from main spindle of headstock. Dial control to change gear without stopping or reducing spindle speed.

Why not take a good, critical look at your present lathes' performance? Write for new Sidney Lathe bulletins or for representative to call.

THE SIDNEY MACHINE TOOL CO.
SIDNEY, OHIO
Builders of Precision Machinery since 1904



Aget Dust Collector Features Roll-Away Collecting Bin

Model 90 NB 50 dust collector is designed for use in grinding, buffing and other operations producing chips, dust or shavings. The roll-away collecting bin has a storage capacity of 37½ cu ft, and moves on rubber-tired ball-bearing casters. Bin top is held in place by luggage type clamps, and a flexible hose runs from cyclone outlet to bin lid.

Collector has air handling capacity of about 10,000 cfm and uses a 15-hp motor. Over-all dimensions are 48 in. deep, 82 in. wide, 124 in. high, with 15-in. fan inlet diameter.

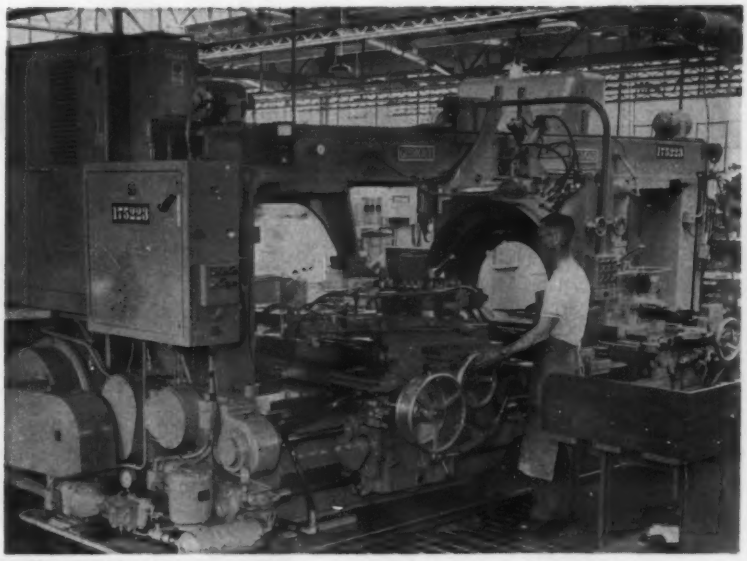
Aget Mfg Co, Adrian, Mich

Fenway Portable Nibbler Has Short Turning Radius

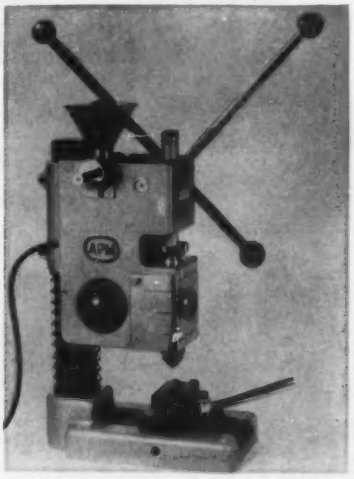
Pneumatic metal-cutting tool weighs 13 lb, measures 13 in. in length, and cuts up to 55 ipm through 10-gage stainless steel. Short turning radius allows special patterns and openings to be cut in sheet metal without special devices.

Tool operates on air motor, 30 cfm, 90 psi, 5-hp 2-stage compressor. Softer metals such as aluminum and brass can be cut in even heavier gages.

Fenway Machine Co, Edgemont & Clementine Sts, Philadelphia 34, Penna



JET COMPRESSOR AND TURBINES DISC are machined on this tracer-type center drive lathe built especially for Pratt & Whitney Aircraft. Machine's ability to cut on both sides of the disc simultaneously cuts time, and improves accuracy by balancing pressure on each side. Five to seven steps have been eliminated and time for machining a jet compressor disc has been reduced from 281 to 181 min.—*Gisholt Machine Co, 1271 E Washington Ave, Madison 10, Wis*



Hand-Operated Plastic Molder Works All Thermoplastics

British-designed portable injection molding machine, the Asmidar APM 21, is a hand-operated unit reported especially suitable for testing purposes. Capable of working all thermoplastics including nylon, machine is fitted with a semi-automatic hopper feed and a leakproof, self-sealing, and interchangeable cylinder unit. A cam-lock vise holds molds of varying sizes and thicknesses.

The ram as well as the cylinder is made of special alloy steel, heat-treated and chromium-plated to insure long life and clean operation. A heat controller, mounted on the side of the casting, is operated by a rotary knob that has a finely divided scale. Injection pressure is 5700 psi. Dimensions: 18 in. high by 8 in. wide by 12 in. deep. Weight is 39 lb.

British Machines & Foundry Supplies Ltd, 80 Shore Rd, Port Washington, NY

High temperature lubricant, Keystone No. 49 Light, reportedly resists oxidation, sludging and breakdown, and is recommended for air compressor use, ring bearings in electric motors, multi-plate friction clutches, and plastic molding heat transfer systems. It has a flash point of 425 F, and a viscosity index of 96 sec. Bulletin 51.

Keystone Lubricating Co, 3100 N 21st St, Philadelphia, Penna

CORRECTION—Two milling machines described in the recent 1957 Production Preview issue (AM—Jan 28 '57, p153) were incorrectly listed as imports of the Aaron Machinery Co. Machines, which are designated the Westbury line, are actually imported by the Maserati Corp of America, 662 Main St, Westbury, LI, NY.

VANADIUM-ALLOYS STEEL COMPANY

FIRST QUALITY

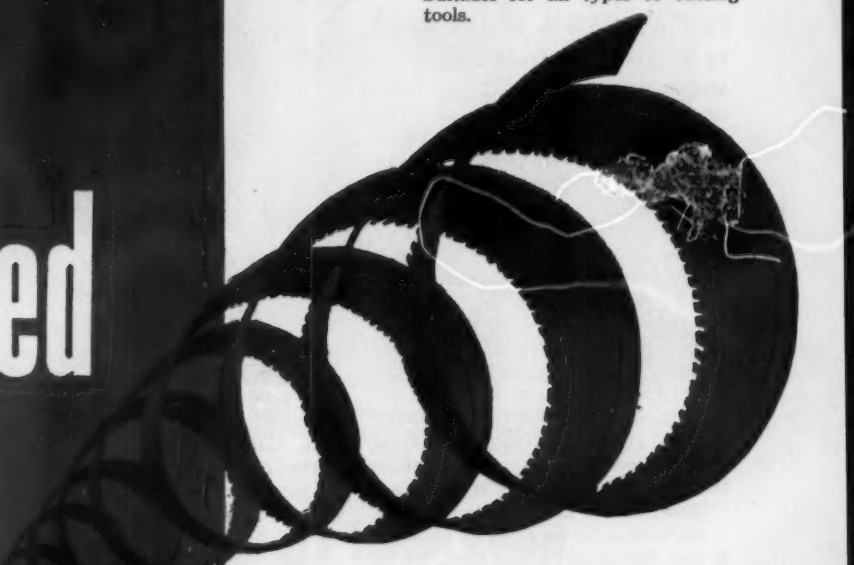
High Speed Steels

wherever outstanding cutting performance must be matched with practical economy on industry's most exacting jobs

Vasco Supreme — The supreme high speed steel, providing highest hardness, highest hot hardness, highest wear resistance, highest cutting efficiency. (U.S. Pat. 2,174,285)

Neatro — For heavy, light and intermittent cuts on heat-treated steels and abrasive materials. Extremely high abrasion resistance, exceeded only by Vasco Supreme. (U. S. Pat. 2,174,286)

Van Cut — Molybdenum-tungsten type, combining ease of grinding with improved wear and heat resistance. Suitable for all types of cutting tools.



Red Cut Superior — America's favorite general-purpose high speed steel. Easy to fabricate, simple to heat treat. Wide choice of carbon content, for almost limitless uses.

Vasco M-2 — The original 6-6-2 type steel. Machines easily, has wide hardening range, can be ground normally when hardened. Excellent economy in general service.

8-N-2 — Molybdenum type, low in tungsten. High toughness, for fine edged tools and sharp angles without chipping or crumbling. Substitutes well for 18-4-1.

Van-Lom — Out-cuts other high-moly steels. Special vanadium content permits increased carbon (U. S. Pat. 2,105,114) without brittleness, for greater toughness, wear resistance.

Write for useful Data Sheets

Vanadium-Alloys Steel Company

Latrobe, Pennsylvania

SUBS'DIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni

7000 and 8000-lb Models Added To Mercury Fork-Truck Line

Models 730 and 830 Yank fork-trucks, 7000 and 8000-lb capacities respectively, feature simplified hoisting mechanisms. Motor-driven, low-pressure vane pump actuates a single-acting hydraulic cylinder. Compactness of mast brings vertical face at base of the fork closer to center line of drive wheels, decreasing overall length of truck.

Hoisting speed is 32 fpm for both models at no load and 17 fpm for model 730 and 15 fpm for model 830 at full load. Lowering speed for both is 40 fpm. Tilt is 4° forward and 10° rearward. Travel speeds of both models are 5½ to 6 mph at no load and 4½ to 5 mph at full load.

Model 730 is 126¼ in. long, 46 in. wide, with a turning radius of 86 in. Model 830 is 132¼ in. long, 46 in. wide with a turning radius of 91 in. Power is supplied from battery or from gas-electric unit.

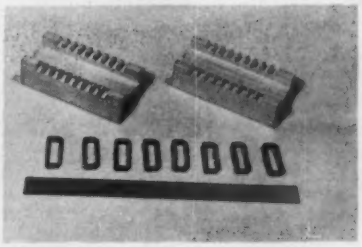
Mercury Mfg Co, 4044 S Halstead St, Chicago 9, Ill

Fine Pitch Gear Hobber Offered in German Model

Gauthier Model W-1 precision gear-hobbing machine is equally suited for production of spur gears as for mass production of pinions by means of magazine feed. Hobber has a range from 5 to 230 teeth and diametral pitches of 30 or finer. Maximum gear diameter accommodated is 2½ in., while maximum gear face is 1 9/16 in.

Attachments are also available to allow the batch hobbing of stamped gear blanks.

Imported by Eric R Bachmann Co, Inc, 27-11 41st Ave, Long Island City 1, NY



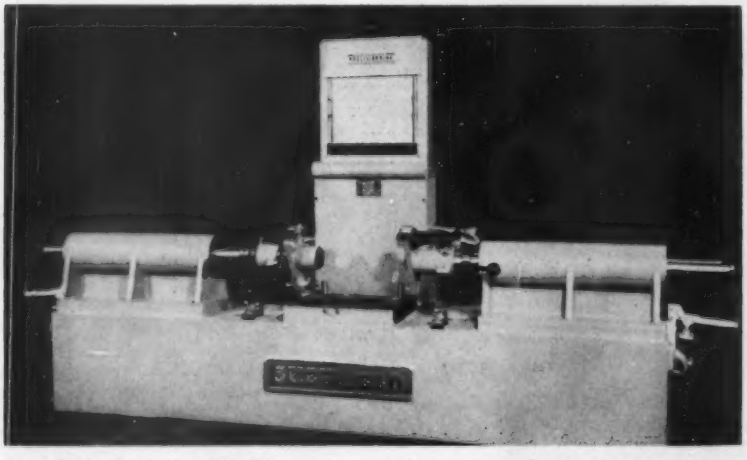
Technion Ceramic Jigs Help To Speed Induction Brazing

Sur-Braze Grade M120-F ceramic is available in raw forms for customer's fabrication, or as precision machined parts from company. Its fabrication requires no special dies, molds, or firing kilns, and the material lends itself to short or long runs using conventional machine tools. Ceramic is non-carbonizing, non-corrosive, acid resistant, and oil- and alkali-resistant.

The material, which can be used in a variety of temperature and electrical applications, is especially recommended for use in the form of jigs to help speed induction brazing operations. Here the material fulfills the needs of a jig suitable for induction brazing; it is a non-conductor with good dielectric strength; it resists flux penetration; it does not warp or oxidize at temperatures over 1200 F; it withstands thermal shock; it is not "wet" by molten brazing alloys; and it can be fabricated into complex shapes necessary to assure proper positioning.

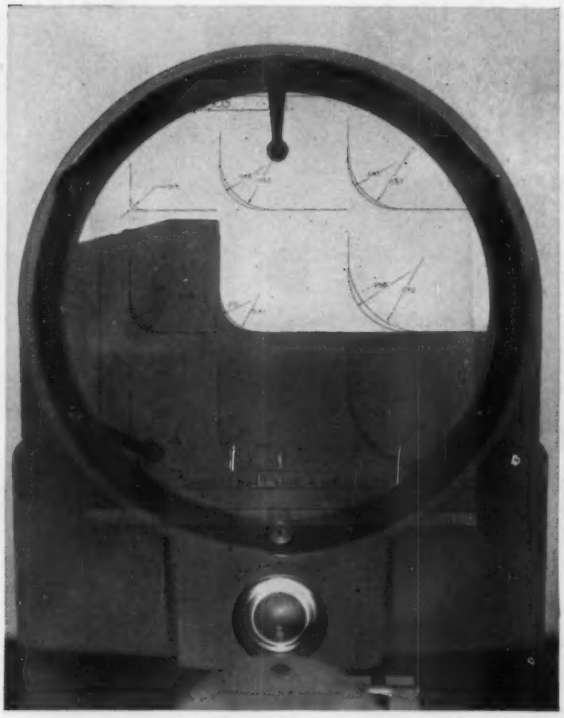
Illustration shows special jigs fabricated for the induction-heating brazing of shaded-pole shunts.

Technion Design & Mfg Co, Inc, 262 Mott St, New York 12, NY

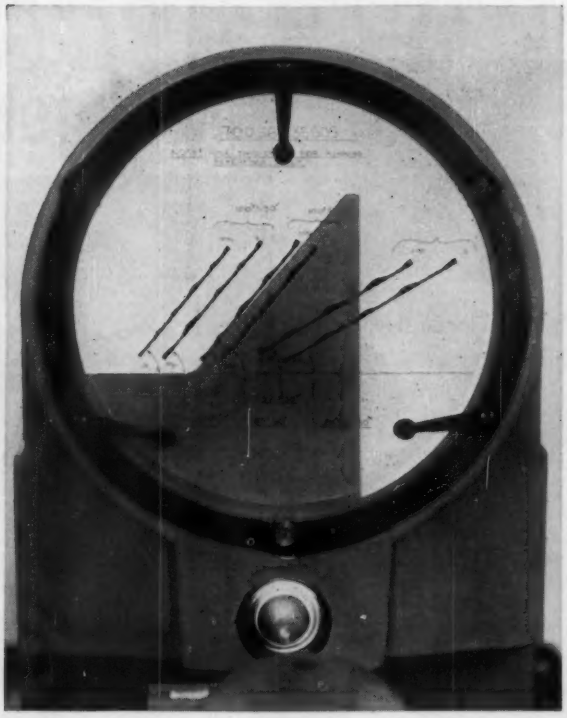


TRANSMISSION HOUSINGS are inspected for three depths, four diameters, and five points of flatness on this 12-column Precisionaire pneumatic gage. Part is slid onto serrated surface and positioned by spring-urged tapered locators. Spindles are progressed into position for gaging diameters and depths. Five Plunjet cartridges in serrated plate gage flatness—*Standard Instruments Div No. 610, Sheffield Corp, Dayton 1, Ohio*

TOWING TRACTOR, Clarktor 80, has 8000-lb maximum starting drawbar pull, four speeds forward and one reverse, four wheel brakes, and automatic coupler. It has a max forward speed of 16 mph, measures 56½ in. high, 107 in. long and 69 in. wide, and has a 146-in. turning radius—*Industrial Truck Div, Clark Equipment Co, Battle Creek, Mich*



1–A typical MS aircraft bolt has a radius tolerance of .031-.041 on the fillet where the head joins the shank. By placing up to 9 radius drawings on a single overlay chart, a number of machine operators can check fillets during production.



2–Another typical job at Standard Pressed Steel Company involves checking the angularity of a 100° flush head bolt to ½°. Angularity is checked at the same time that the radius is measured to .0015″ (limits are .016-.019).

How Kodak Contour Projectors help keep gage inventories low in production checking

Standard Pressed Steel Company—manufacturer of aircraft bolts, socket screws, and other close-tolerance fasteners—once needed as many as 26 radius gages to check the fillets of *each type of bolt* it made while the bolts were in production.

Multiply this figure by the number of types of fasteners . . . add the gages required for checking other dimensions such as root radii—and you get an idea of the vast inventories involved in conventional inspection methods.

Now SPS does much of its production inspection by optical means with Model 8 Kodak Contour Projectors—and gage inventories have been slashed for these 4 important reasons:

- Light in weight, the Model 8's can be readily moved, used where needed on the production line.
- A single Contour Projector can serve several machine operators, since one screen chart can show tolerance limits for as many as nine different radii. (Fig. 1)
- A single chart can check several dimensions at once on a given part. (Fig. 2)
- By interchanging charts, the same Projector can be used to check a variety of parts—bolts, flat-head screws, or socket screws. (Fig. 3)

Model 8 and other Kodak Contour Projectors can help simplify your measurement and inspection problems, too. For full details write for our illustrated booklet, "Projection Gaging with Kodak Contour Projectors," or ask for the name of the Kodak field representative in your area. He'll be glad to advise you.

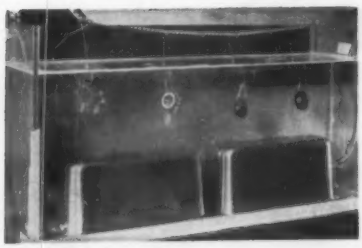
3–Here an operator uses a Model 8 Projector to check the root radius of threads to tolerances on the order of .002″.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

Apparatus and Optical Division

the KODAK CONTOUR PROJECTOR

Kodak



Ultrasonic Transducer Features High Energy Conversion

Ultrasonic immersion transducer of all-welded, stainless-steel design provides 52 sq in. of radiating area for tanks and vats. Method employed to couple and reinforce the crystal transducers through solid-metal matching elements is said to result in nearly 90% conversion of energy and to provide exceptional ruggedness and long life. Designated D-52 Sonicell, transducer operates at 20,000 cps.

General Ultrasonics Co, Hartford, Conn

Single-Station Unit Deburrs, Chamfers Large Pinions

Model BMHP-15 Burr-Master, a single-station machine for deburring and chamfering medium-to-large hypoid pinions with long or short shafts, handles pinions of 8 to 15 teeth, with an OD range of 3¼ to 8 in. and with shaft lengths up to 15 in. Maximum rate of production is 280 gears per hr.

Automatic machining cycle is pushbutton controlled, and one operator can easily handle two machines. Machine does the following: deburrs and chamfers acute-angle profile and part of root at toe end of each tooth; does the same at heel end of each tooth; and, when required, produces a peripheral chamfer on large end, removing sharp edges.

Cutting is dry; coolant is unnecessary. Depth of cut is readily adjustable. Machine is provided with a built-in chip-disposal chute, and automatic chip disposal is available if required.

Modern Industrial Engineering Co, 14230 Birwood Ave, Detroit 38, Mich

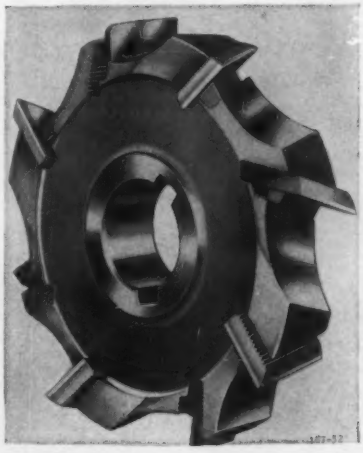
Walker-Turner Tool Grinders Offered in Several Models

Two "light-heavyweight" tool grinders engineered for accuracy and long life have recently been introduced by the Walker-Turner Div of Rockwell Mfg Co.

Six-in. carbide tool grinder has the following features: cast-iron tables ride on widely spaced trunnions for maximum rigidity in operation; tables tilt 30° in and 45° out to permit wet or dry grinding at any angle; six-pole reversing switch instantly reverses wheel rotation, so that all grinding can be done on downward motion of wheel; aluminum wheel flanges are drilled for mounting either silicon-carbide or diamond wheels. Machine retails for $187.75.

Seven-in. tool grinder (not illustrated) has a specially designed motor with extra-long shafts, providing ample clearance between wheel and motor. Oval-shaped end bells make possibe full use of the side of the wheel, in addition to giving the shaft rigid support. Other features: shatterproof glass safety shields, permanently lubricated ball bearings, adjustable spark deflectors, and integral dust chutes. Unit retails at $170.65.

Walker-Turner Div, Rockwell Mfg Co, 400 N Lexington Ave, Pittsburgh 8, Penna

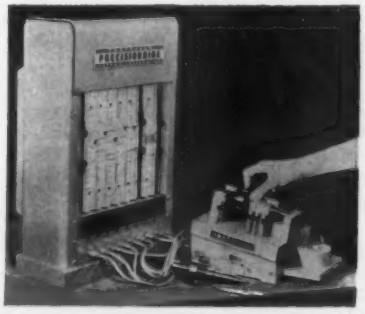


Slotting Cutters Are Designed For Use on Light Metals

Featuring flat-faced blades and a staggered tooth arrangement, the WAD series cutters, designed for cutting aluminum, its alloys and other light metals, come in 102 sizes ranging in width from ⅜ to 2 in., and in diameter from 4 to 16 in. Two keyways are provided; one to stagger teeth when interlocking cutters, the other to line up teeth when straddle milling thin parts. Wedges hold blades in cutter body.

All chip spaces are polished to aid disposal. Axial blade serrations allow easy width settings. Cutter blade replacements are available for all sizes.

Goddard & Goddard Co, 12280 Burt Rd, Detroit 23, Mich



MULTI - DIMENSION CRANKSHAFT GAGE, called Precisionaire, checks four diameters simultaneously, taper, throw diameter and throw dimension on crankshaft of air conditioner compressor unit at a rate of 350 to 400 parts per hr. Gage consists of bench-type holding and locating device, bottom-type air ring, airsnap, and 8-column Precisionaire—*Sheffield Corp, Dayton 1, Ohio*

ROCKWELL-BUILT

DELTA 11" metalworking lathe

"You can't beat it for precision work"

say Sam and Charles Lentini, Co-Owners, Jacy Manufacturing Co., Brooklyn, N.Y.

ACCURACY TO 0.0003 INCH. The Lentinis use their Delta 11" Lathe to machine precision instrument parts and components for the aeronautical and electronics industries where extremely close tolerances are demanded. Their Delta meets these exacting demands down to plus-minus 0.0003-inch tolerance. Sam Lentini points out that the lathe's L-00 tapered key drive chuck insures a positive grip on the work.

SHIFTS OPERATIONS QUICKLY. With their Delta 11" lathe, the shift from turning or boring to threading or tapping is done with complete ease. There's no time lost in changing set-ups. "The big, legible dials on the Delta lathe make precision machining fast and easy," explains Charles Lentini.

CONSISTENT QUALITY. Jacy men get the same high quality results in metals ranging from brass to titanium—in lots as large as 30,000 or small as 10. As Sam Lentini points out, "For doing precision work in small lots or large, you can't beat the Delta 11" metalworking lathe."

PAYS ITS OWN WAY. "In a shop like ours with a variety of work, every tool must be versatile enough to pay its way on every job," says Charles Lentini, "and *we have yet to find a precision job that our 11" Delta couldn't do.*"

SEE THE ENTIRE DELTA 11" METAL LATHE LINE. Compare—and make up your own mind. Your Dealer is listed under "Tools" in the Yellow Pages of your phone book.

Send coupon for all the facts!

DELTA ROCKWELL

another product by **ROCKWELL**

Delta Power Tool Division, Rockwell Manufacturing Co.
618C N. Lexington Ave., Pittsburgh 8, Pennsylvania

☐ Please send Delta Industrial Catalog on entire Delta 11" Metal Lathe Line.

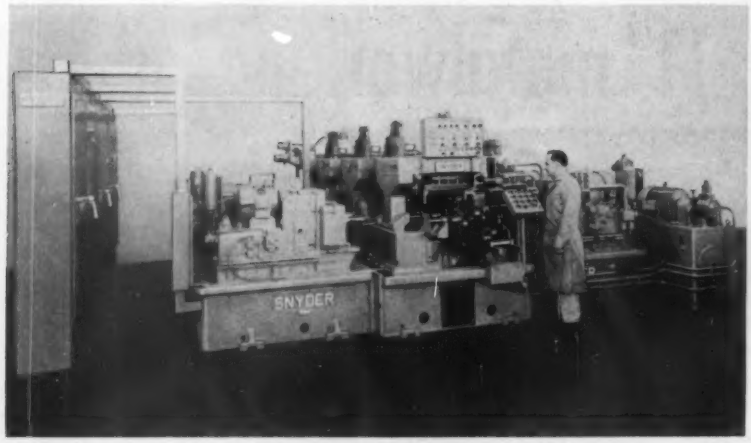
☐ Please send name of my nearest Delta Dealer.

Name_____ Title_____

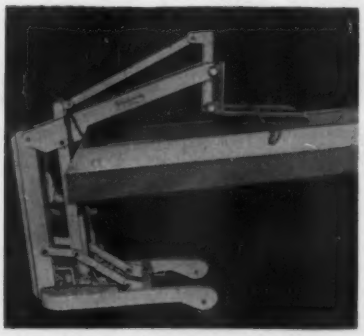
Company_____

Address_____

City_____ County_____ State_____



FORGED STEEL OR CAST IRON CRANKSHAFTS are drilled, bored, chamfered, reamed and tapped on this 13 station, 4-segment transfer machine, designed to maintain concentricity of tapped holes with a bored center hole. Machine produces 112 pieces per hr. Carbide tools are used for many of the operations. Tapped holes are reamed before tapping to provide maximum thread-depth accuracy —*Snyder Tool & Engineering Co, 3400 E Lafayette, Detroit 7, Mich*



Autoquip Fork Truck Has High Lift, Low Weight

Designed to eliminate the need for load counterweight, Hydrauliphant weighs less than 3000 lb, yet has a lift height of 108 in. and lift capacity of several thousand lb. Unit will handle machinery, bales, barrels, skids, pallets, and long loads of pipe and beams. Truck has single-pedal drive, small steering wheel, and an extra "inching" speed for precise positioning. Line is available in four models, all electrically powered to eliminate gasoline engine fumes.

Autoquip Corp, 1140 S Washtenaw, Chicago 12, Ill

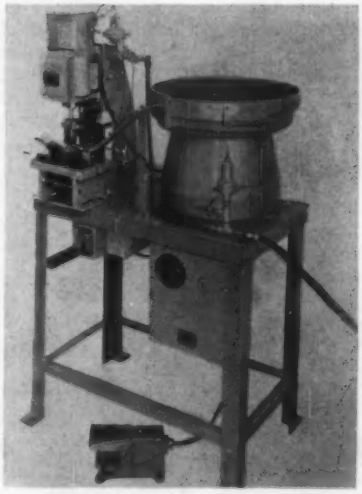
Instrument Controls Temperature Of Four to Ten Separate Units

Multi-point pyrometer controller permits automatic temperature control of 4 to 10 separate units with one instrument. It is applicable to almost any 2-position control action—including creep test machines, multi-zone ovens and furnaces, and batch process units.

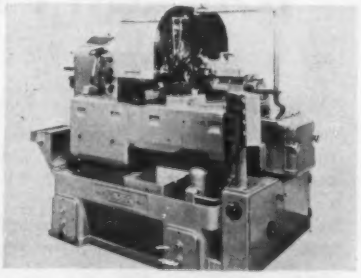
In operation a pulse timer and selector-switch automatically connect thermocouples in sequence to the master control unit which compares each thermocouple voltage to its set point, and energizes or de-energizes the corresponding load relay to the process unit. Usual operating speed is 3 sec per point, but other speeds can be achieved by changing gears.

Null balance potentiometer measuring circuit assures high accuracy. Many temperature ranges are available between –400 F and +3250 F for standard thermocouple calibrations, and from –100 F to +1600 F for resistance bulbs.

Thermo Electric Co, Inc, Saddle Brook, NJ



CLIP FEEDER AND STAKER UNIT orients and then stakes clips to automobile window trim. Unit, consisting of vibratory feeder and an electro-punch device adapted for staking, replaced a hand-fed punchpress — *Automatic Methods Inc, 802 W Grand St, Elizabeth, NJ*

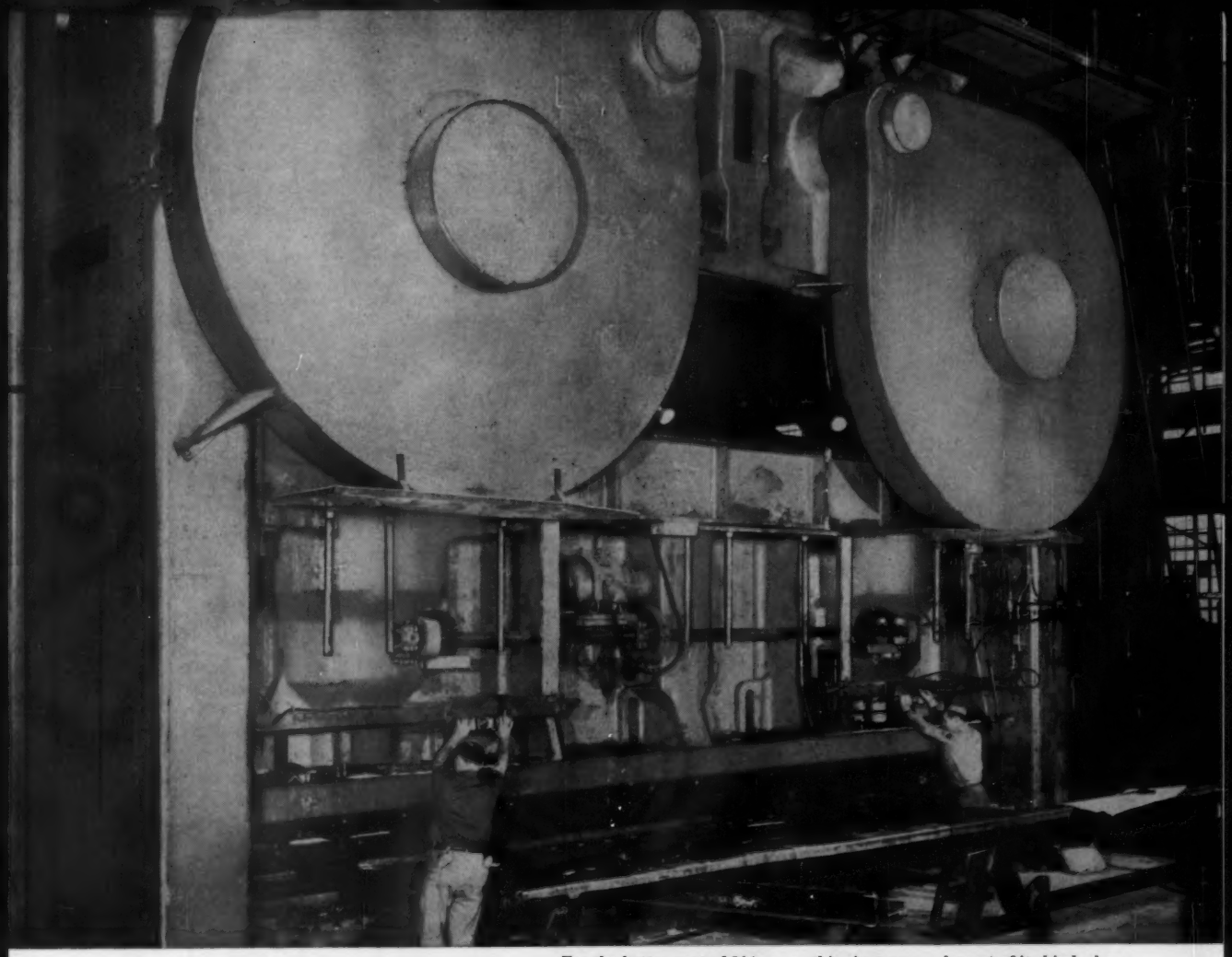


Swiss Single-Spindle Automatic Turret Lathe Available in 3 Sizes

Tarex Model TAR/L is a basic, fully integrated machine designed and built on the unit system of interchangeability. Among the standard elements that can be added are the following: cam shaft accelerator, optional spindle speed units, single or compound front and rear slides, and high-speed drilling attachments.

Machine comes in three sizes: 1¼, 1⅝, and 2 1/16-in. capacity. Max chucking diameter is 4½ in.; swing is 6 in.; spindle speed ranges from 55 to 4730 rpm. Lathe can be supplied with either a 6 or 8-position turret and single or double indexing.

Distributed by Russell, Holbrook & Henderson, Inc, 292 Madison Ave, New York, NY



For the better part of 3½ years, this giant press—largest of its kind—has operated three shifts a day, seven days a week, doing with a single hit what formerly required two forming operations on a 3000-ton press.

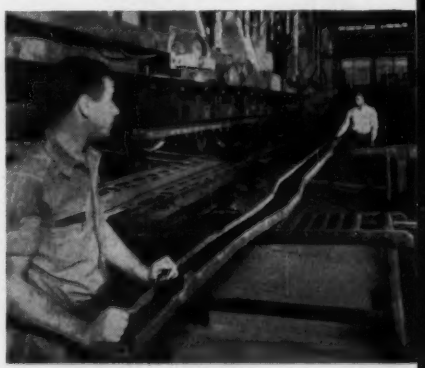
4000-ton Hamilton press produces formed truck and bus rails from flat blanks in a single hit

By producing completely formed side rails from flat blanks in a single operation, this press has eliminated costly and time-consuming die changes, storage of partly formed rails between operations, and attendant materials handling problems. It does not give camber, or bow, to the rails and so this huge Hamilton press has eliminated the need for intermediate and final straightening operations.

Simplicity of lubrication is an important factor in the successful operation of this press. A special system, built in during installation, results in positive, efficient oiling of all moving parts with foolproof ease.

For all its 4000-ton capacity, the press weighs only 900 tons, stands only 43 ft. high, and is only 30 ft. 10 in. wide, 12 ft. 10 in. deep. It is driven by a 150 hp motor turning up 1200 rpm. The stroke is 22 in., operating speed is seven hits per minute.

Write to Hamilton Division, B-L-H Corporation, for full information and specifications on the line of Hamilton heavy duty presses.



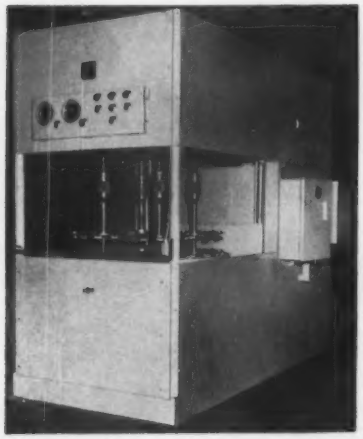
Low-carbon sheet steel side rail blanks up to 26½ ft. long by 3/8 in. thick are fed into the press at the Cleveland Plant of Midland Steel Products Company. The operating crew varies from four to eight men, depending on size of rails being formed.

Hamilton Division Hamilton, Ohio

BALDWIN · LIMA · HAMILTON

Diesel engines • Mechanical presses • Can making machinery • Machine tools

BALDWIN BLH LIMA-HAMILTON

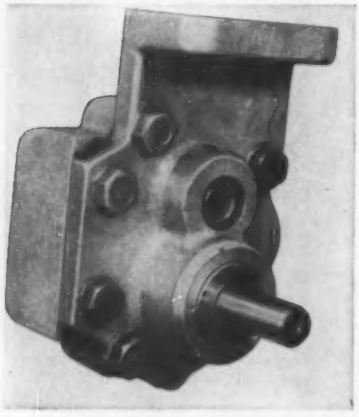


Buffing and Deburring of Metal Parts Simplified by New Process

Spin-Finish process, using a special-formula compound, reportedly produces surfaces and lustre comparable to or surpassing those resulting from conventional buffing. It finishes a multiple mounting of parts in a single, automatically timed operation, and is designed for brass, zinc-base and aluminum die-cast parts.

In addition to handling a number of like parts in a single set-up, groups of as many as four different parts may be run simultaneously. Operating cycles of the process vary from 4 to 16 min. Fixture on machine permits rapid cam-locking of parts.

Grav-i-flow Corp, Sturgis, Mich



Gear Pump Is Designed To Use Lowcost Mass-Produced Gears

Designed for fluid pressures up to 200 psi, new pump can be adapted to many applications including engine oil pump, fuel injection pump, pump for low pressure machine tool mechanisms and other manufacturing equipment.

Molded rubber diaphragm installed under the two gears permits a reasonable degree of backlash in the mounting of gears in the housing. In operation, diaphragm is automatically inflated by pressure fluid, thereby taking up all clearance between upper and lower faces of gears.

New Products Corp, 3636 Oakton St, Skokie, Ill

Vapor Steam Cleaner Operates at 120-lb Pressure

Model 45 consumes 1¼ gal of No. 1 fuel oil per hr to turn 45 gal of water per hr into an effective steam cleaning jet.

Venturi - type solution - lifting steam- cleaning gun mixes a concentrated alkaline cleaning solution with the steam, then solution may be turned off and equipment being cleaned can be rinsed with clean steam, ready for painting. A 1/3-hp 110-v motor, with overload cutoff, drives the positive-displacement water pump. Fuel-oil tank reportedly holds enough to do four hours of steady cleaning.

Vapor Heating Corp, 6420 W Howard St, Chicago 31, Ill

Chemical Immersion Process Descales Titanium and Its Alloys

Process reportedly descales titanium and its alloys without adversely affecting the physical and chemical properties of the metal. Two immersion steps (one for scale conditioning and one for scale removal) and two rinsing steps are required after the heat forming or heat treating operation.

Relatively low temperatures, 270-280 F, are needed, and low metal loss, .0001 to .0003 in. per side, is reported. Process is suitably inhibited to prevent hydrogen embrittlement, will not warp thin gage material, and eliminates salt entrapment in faying edges.

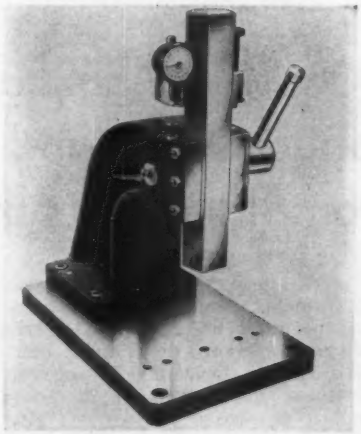
Turco Products, Inc, 6135 S Central Ave, Los Angeles 1, Calif

Relief Grinding Fixture Is Cam-Actuated Device

Relief grinder uses a single solid cam for infinite adjustment of clearance lift. Index hubs containing indexes for different numbers of flutes can be slipped on or off in seconds. Extended spindle in rear permits addition of pulley to motorize.

Device uses 5-C collets, has rugged base graduated to 360°, weighs 26 lb.

Steptool Co, 3613 E Olympic Blvd, Los Angeles 23, Calif



HAND PRESS called Micro can be used for piercing, broaching, forming, press fits and burnishing. Machine-steel ram and gear rack are constructed as a single unit. Depth of throat is 4⅞ in., distance of ram to base ranges from 7-in. maximum to 1¾-in. minimum, and base dimensions are 9 x 14 in.—*Queens Tool Mfg Co, Inc, 15 Front St, Rockville Centre, NY*

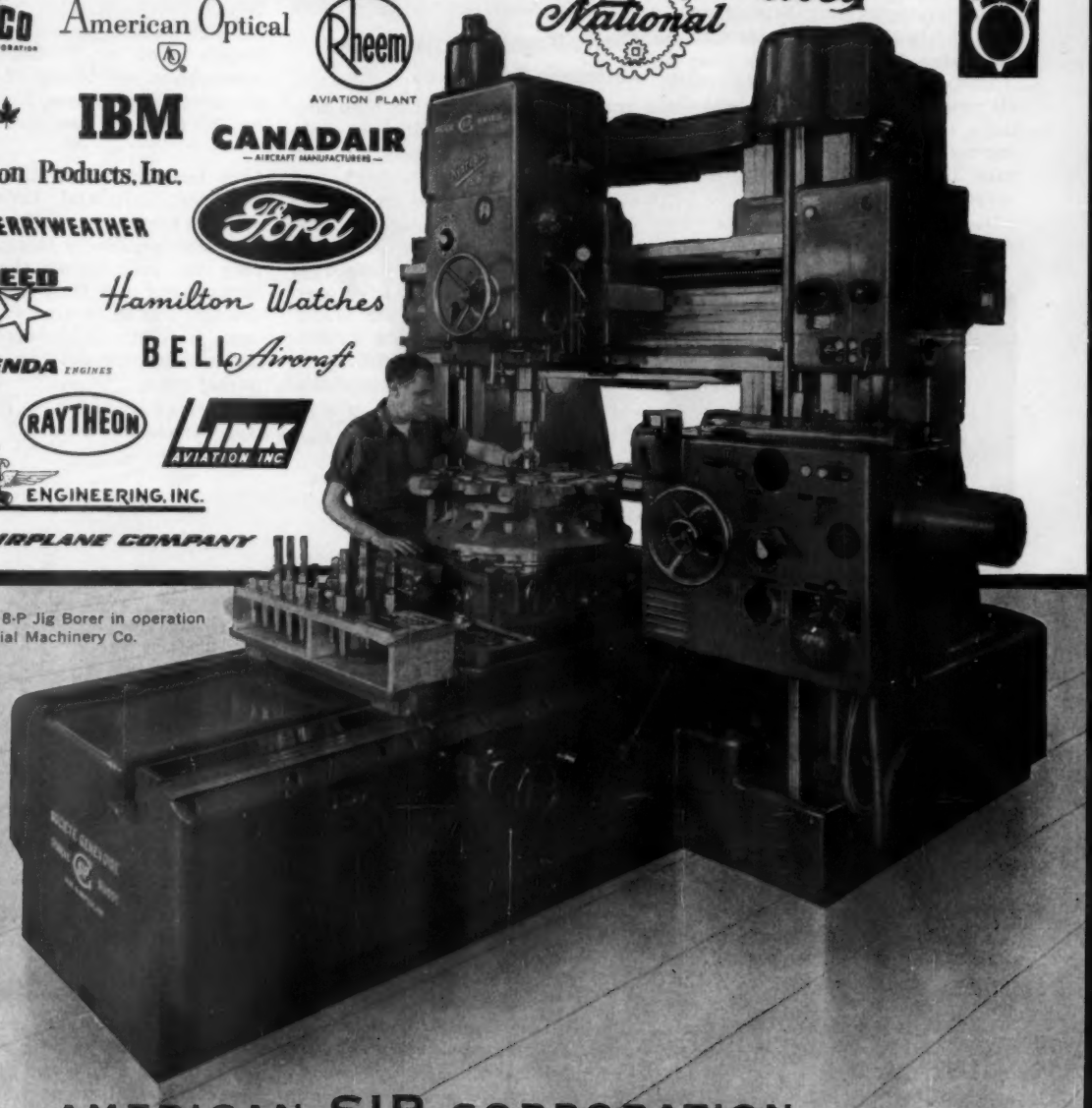
SIP

Guaranteed Accuracy

More and more manufacturers apply SIP *Guaranteed* Accuracy to define, establish and maintain high precision in production and measurement to improve quality-of-output and economy-of-operation.

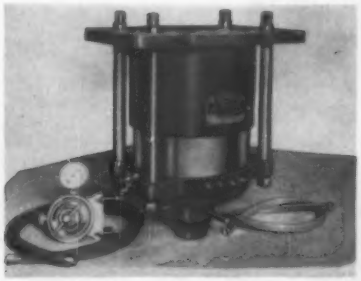
NORTHERN ORDNANCE INCORPORATED

TEMCO AIRCRAFT CORPORATION
American Optical
Rheem AVIATION PLANT
National
Avey
SPERRY
IBM
CANADAIR — AIRCRAFT MANUFACTURERS —
Thompson Products, Inc.
MOTCH & MERRYWEATHER
Ford
LOCKHEED
Hamilton Watches
RENDA ENGINES
BELL Aircraft
RAYTHEON
LINK AVIATION INC
Merz ENGINEERING, INC.
BOEING AIRPLANE COMPANY



SIP HYDROPTIC 8-P Jig Borer in operation at Hartford Special Machinery Co.

AMERICAN SIP CORPORATION
HIGH PRECISION MACHINE TOOLS & MEASURING EQUIPMENT
100 EAST 42nd STREET, NEW YORK 17, N. Y.

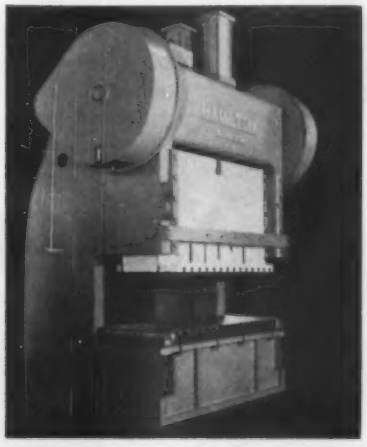


Pneumatic Air Cushion for Punch Presses Available in Eight Sizes

Universal Model DX pneumatic air cushion for punch presses is of all-steel construction, and comes in eight sizes, developing ring holding pressure of 1 to 20 tons on standard shop air lines.

Unit comes ready to install with all necessary high pressure hose fittings, including combination reducing-regulating valve and pressure gage. It can be installed on the average press in 4 or 5 hr.

Dayton Rogers Mfg Co, 2824 13th Ave S, Minneapolis 7, Minn



Hamilton Gap-Press Line Offered in Lighweight Models

Line of gap presses, ranging in capacity from 100 to 300 tons in both single- and double-crank types, was developed primarily for shallow drawing, forming, and blanking in the automotive industry. Applicable in other industries, such as appliance manufacturing, presses have bed areas large enough to accommodate the sizeable blanks that are formed into auto-body grille and bumper guards.

Units incorporate a pneumatically operated flywheel brake, pneumatic clutch with electric control system, and pneumatic counterbalance. Motorized slide adjustment is accomplished through barrel screws, which remain vertical at all positions of the stroke.

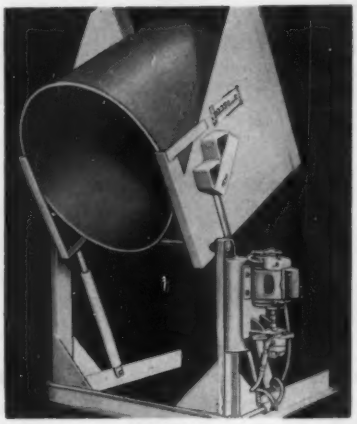
Hamilton Press Div, Baldwin-Lima-Hamilton Corp, Hamilton, Ohio

Electro-Magnetic Drillpress Has Automatic Power Feed

Automatic power feed has been added to the Portomag drillpress, making it possible for operator to run drill point down to center mark, turn on automatic feed, and let drill do the work. Electromagnet in base clamps unit to work.

Power feed can be engaged or disengaged at any time during operation, and depth of cut per revolution can be set according to drill size. Unit is reported to drill up to 1¼-in. and tap 1-in. holes accurately.

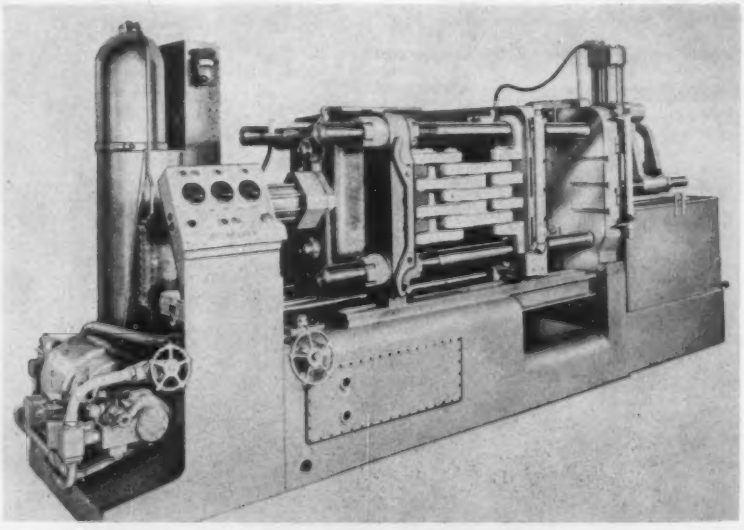
Portomag, Inc, 1511 E Nine Mile Rd, Ferndale 20, Mich



TUBAR TWIN-CYLINDER HYDRAULIC DUMPER elevates loads to 2000 lb at heights to 60 in. Portable, electric-motor-driven unit uses a 12-v battery or conventional power line—*Uhrden, Inc, PO Box 193, Dennison, Ohio*

Live bushing for piloting applications on horizontal boring mills replaces bronze bushing in outer support, and reportedly increases accuracy by maintaining close fit of bushing and bar. Only moving parts are two sets of tapered roller bearings. Bushing can be adapted to receive removable slip bushings, keys or keyways.

Donley Products, Inc, 11106 Avon Ave, Cleveland 5, Ohio



DIE CASTING MACHINE, Unicaster Model 120, has a 450-ton capacity and features simplified, self-contained hydraulic system mounted on a sub-base of unit, accessible oil filters, easily-removed tie bars, and a simplified shot end design in which only two nuts are used for final clamping of nozzle to die. Operator's electrical control permits switch-over from automatic cycling to manual operation. Brochure UP-121—*Unit Products, Div of Uniloy Corp, Saline, Mich*

Talide Die

cuts molding cost

7¼¢ to 1¢...

● Simonds Abrasive Company, a leading producer of abrasive wheels, called in a Talide Die Engineer to help reduce excessive die costs. The highly abrasive action experienced in molding the wheels to shape cut service life of hardened steel dies to 3000 wheels. A Talide carbide die having 6" I.D. was designed and, due to its super hard and dense structure, approximately 25 times the number of wheels were pressed! $4,708.80 worth of steel dies would have been required to equal the production of this one $690.00 Talide die. **Metal Carbides Corporation, 6001 Southern Boulevard, Youngstown 12, Ohio.**

SIMONDS ABRASIVE COMPANY

GRINDING WHEELS ABRASIVE GRAINS

TACONY AND FRALEY STREETS PHILADELPHIA 37, PENNA.

TELEPHONE JEFFERSON 8-6100

February 13, 1956

Metal Carbides Corporation
107 E. Indianola Ave.
Youngstown 7, Ohio

ATT: Mr. R.T. Beeghly

Dear Mr. Beeghly:

At the request of your Mr. J.R. Macek, I am forwarding information about our molding die costs for the manufacture of grinding wheels pressed on an automatic press.

When we first began to use automatic presses in our process we set up with steel dies which gave us a molding die cost of $.0725 per piece produced. We then went to Metal Carbides dies which gave a per piece die cost of $.0175. Further changes to a different grade have given a per piece die cost of $.015.

We have recently had one of these dies reworked and have noted still further increase in life and a per piece die cost of $.0106.

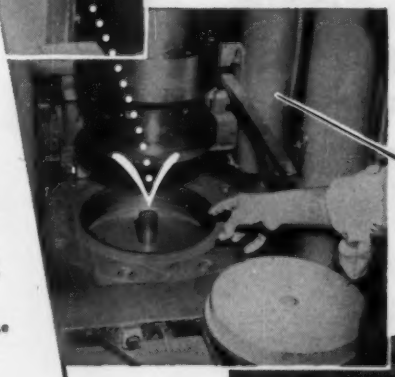
Needless to say, we are quite pleased with the results obtained. If we can produce further information, please let us know.

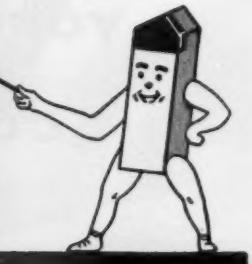
Very truly yours,

SIMONDS ABRASIVE COMPANY

William Kohn
Tool Engineer

MK:RJ





DEEP DRAW DIES

25,680,000 outlet boxes drawn with TALIDE—Steel dies average 700,000.

POWDERED METALLURGY DIES

Compacting highly abrasive chemical powders, TALIDE Pill dies last 4 months, steel dies wore out in 6 hours.

HEADING AND EXTRUSION DIES

Cold-heading ¼" C-1008 steel rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

Send for Catalog 56-G or ask for Talide Die Engineer to call

METAL CARBIDES CORPORATION

MC

TALIDE®

YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

. . . check with Milford Engineers!

Riveting raises *special* problems and requires *special* skills. You must have the right type and size rivet for each application, or the results can be costly . . . in production and in profits. When you're faced with a riveting problem, let Milford engineers lend a hand before designs are fixed!

To improve product appearance and strength
. . . to take full advantage of automatic assembly
. . . to cut delivery time and production costs
—get in touch with Milford first!

THE MILFORD RIVET

MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNSYLVANIA
ELYRIA, OHIO • AURORA, ILLINOIS • NORWALK, CALIF.

Fluidizers Are Custom-Made For Irregular Targets

Dip coating of irregularly-shaped targets has been simplified by introduction of custom-made units in square, cylindrical and rectangular shapes. Units come in sizes from 15 in. in dia, and 6 ft deep in the powder bed, to 4 x 4 x 4 ft and 40 in. deep in the powder bed. Unit illustrated is 3 x 3 x 3 ft with covers, and was built for General Electric Co, Louisville.

All custom-made units are equipped with auxiliary blower assemblies to aid in fluidization of the powder where customers' compressed air volume is not sufficient.

American Agile Corp, P O Box 168, Bedford, Ohio

Angle Adapter Increases Gyro-Vise's Versatility

Adapter permits movement of Gyro-Vise up and down in an arc, increasing versatility of the vise which normally operates from and rotates

Mattison grinders used to produce high-quality engines at new Chrysler of Canada motor plant

HIGH-POWERED GRINDING METHODS AT CHRYSLER

You might find the answer to your production problems in the way high-powered surface grinders are used for high-speed precision machining at the new Chrysler of Canada motor plant, Windsor, Ontario.

Quality production is one of the deciding factors in the choice of machinery for this new 13.8 acre plant. Chrysler executives and plant managers look for the best equipment available for the production of V-8 engines.

Typical of the latest types of machine tools to be installed were two Mattison Rotary Automatic Surface Grinders, one Mattison Duplex Rotary Surface Grinder, and one Mattison Vertical Rotary Surface Grinder.

Case histories on the following pages show three different examples of how Chrysler of Canada produces parts in large volume while maintaining "higher than ever" quality standards on Mattison high-powered precision surface grinders.

MATTISON
HIGH-POWERED PRECISION

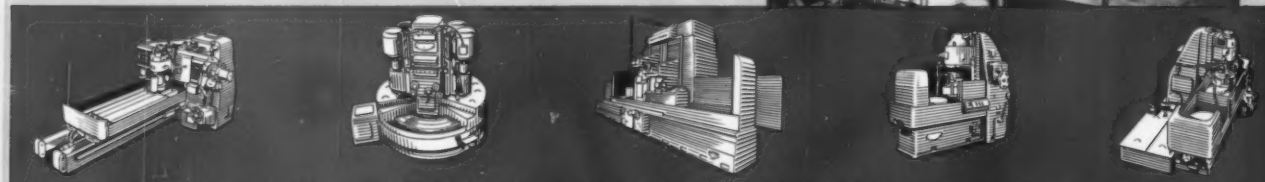
IF IT'S A FLAT SURFACE THERE'S A MATTISON TO GRIND IT!

GRINDING TWO SIDES OF CONNECTING RODS AND CAPS AT RATE OF 375 EACH PER HOUR

Two Mattison No. 72 Four-Spindle Rotary Automatic Surface Grinders are used in the new Chrysler plant to grind tough, forged steel connecting rods, caps, and assemblies at a high rate of production. Chrysler specifications require precise parallelism and flatness to within .0005″; the size is held to within ±.001″.

Mattison Rotary Automatics grind tough forgings to precision limits!

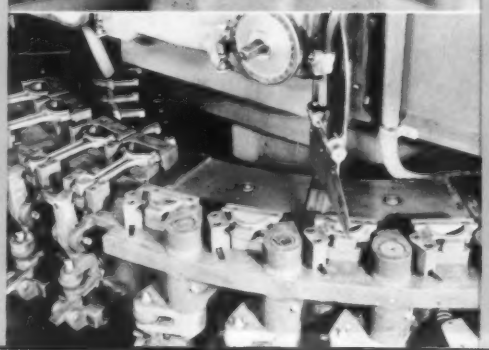
Crank and pin faces on both sides of the connecting rods and caps are ground on the first No. 72 at the rate of 375 each per hour. The second machine grinds the crank faces and pin faces of 432 complete connecting rod assemblies every hour. Accurate, one-pass grinding of flat surfaces at high speed and low cost is the big advantage of these high-powered multiple-spindle machines.



SELECT THE RIGHT GRINDER FOR YOUR JOB FROM MATTISON'S COMPLETE LINE OF

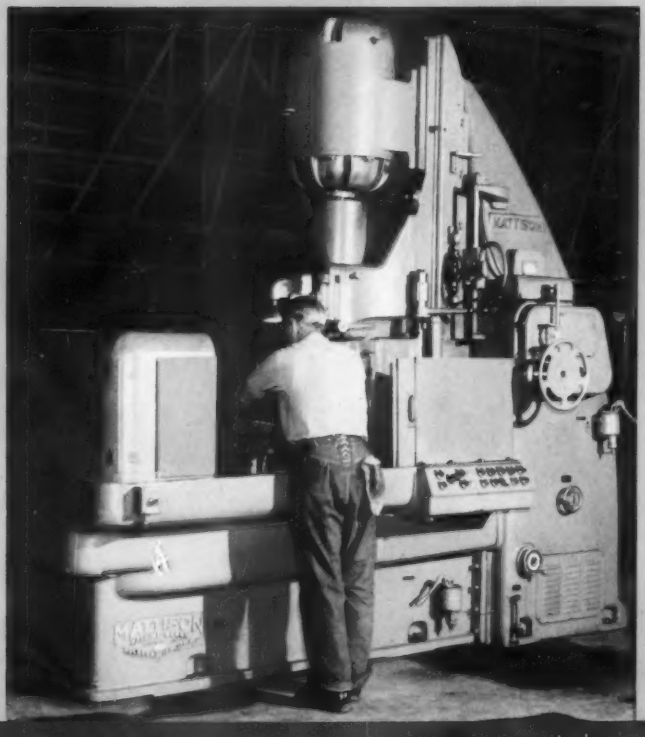
Continuous single-pass grinding, with automatic sizing and clamping

In the Chrysler installation, high production and top quality are provided by Mattison's automatic, continuous single-pass grinding, sizing, and clamping. Automatic cam-actuated clamping and unclamping devices (photo, bottom right) are used to simplify and speed loading and unloading. Centralized automatic feeds help control quality and save production time . . . wheel wear is automatically gauged and compensated for by work sizers (photo, top right) and the automatic feed mechanism. When piece-parts approach their high limit, the machine feeds down a predetermined amount from .0001 to .001″ for the finishing cut; accuracy of feed is within .0001″. For complete facts and features on Mattison Multiple-Spindle Rotary Automatics . . . including more case histories . . . write for new Bulletin No. 147-2.



FINISH TWO FACES OF

THREE DIFFERENT SURFACES ON CHAIN CASE COVER GROUND AT 13 PER HOUR



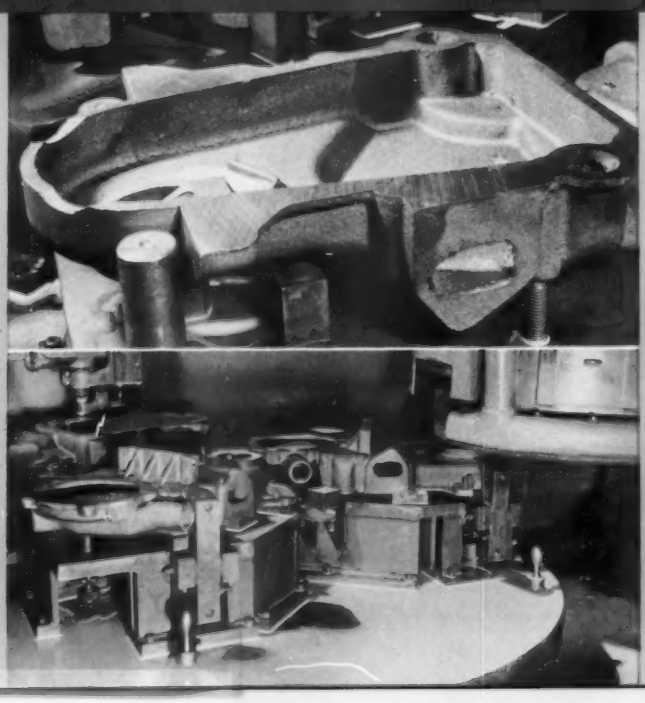
Power and rigidity pay off on heavy stock removal job!

Chrysler machines three faces of heavy cast iron chain cases in one setup on a Mattison No. 36 Vertical Rotary Surface Grinder. Production rate is 13 cases per hour grinding three different surfaces simultaneously.

Three pieces are mounted on the worktable at one time, each with a different face aligned for grinding. The table passes the work under the wheel at the rate of 30 rpm. Wheel speed is 900 rpm . . . downfeed is .060 in. per minute. Automatic sizer checks each piece as it leaves the wheel and corrects wheel feed accordingly . . . parallelism is held to .001 in. Heavy stock removal at production speeds and close tolerances on large or small surfaces is readily achieved with the machine.

Special jig fixtures hold cases in position (photos at bottom left) and prevent deflection under high unit pressures.

80 DIFFEREST MACHINES · SURFACE GRINDERS · FACE GRINDERS · DISC GRINDERS

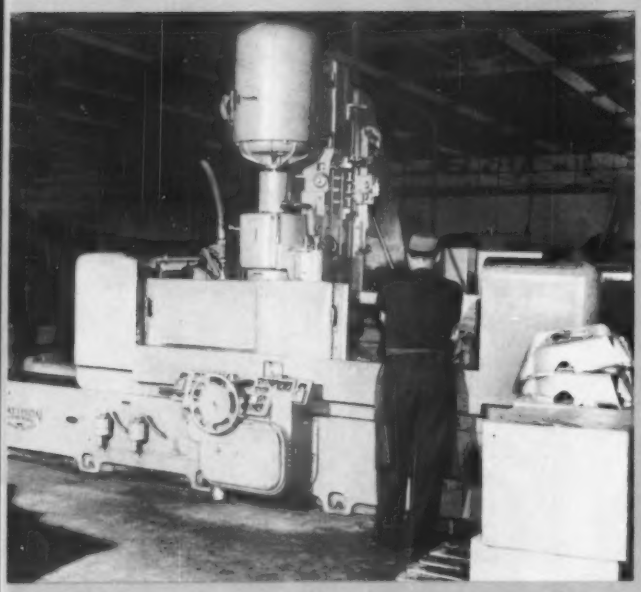


Three cases are mounted at one time, each with a different face ready to be ground. Note automatic sizer in upper left-hand corner of the photo below. Write for case histories showing how Mattison Vertical Rotaries can help you control quality and costs.

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS AT CHRYSLER

NEW SHOP EQUIPMENT |



FINISH TWO FACES OF TORQUE CONVERTER HOUSINGS—40 PER HR

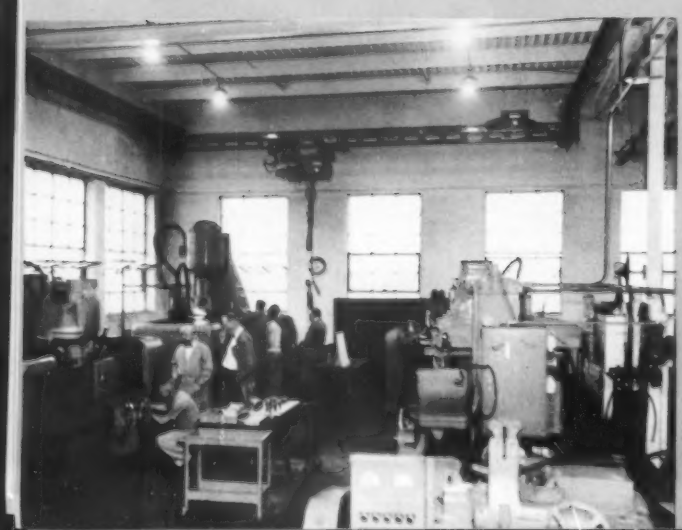
These aluminum alloy castings are finish-ground on two sides by the No. 24 Rotary Duplex at rates as high as 40 pieces per hour using special fixture. Two-table design greatly reduces down-time . . . one table is under the wheel while operator is setting up the other.

Special fixtures prevent springing aluminum alloy castings

The construction of these cast aluminum alloy housings calls for special handling to avoid "springing" the work when grinding. Working with Chrysler, Mattison engineers were able to develop a special jig which holds the work rigidly . . . permits maximum stock removal and accuracy.

Using this special fixture, the machine finish-grinds engine and transmission faces of these housings . . . parallelism and flatness are held to .003″ . . . wheel speed is 750 rpm . . . downfeed is approximately .140″ per minute making good use of the machine's extra power and rigidity. To satisfy Chrysler's high-quality standards, it takes a machine whose massive construction guarantees rigidity and long-run consistency. High-powered spindle drive provides positive, free-cutting action, assuring high production and accuracy.

SEND US YOUR PARTS FOR FREE DEMONSTRATION GRIND!



The Mattison Methods Laboratory, equipped with all major types of modern surface grinders, face grinders, and disc grinders, introduces a new service to metalworking plants. You are invited to submit parts for sample grinds and production estimates. Please include part prints, operation or route sheets, and all special requirements for machining your pieceparts.

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

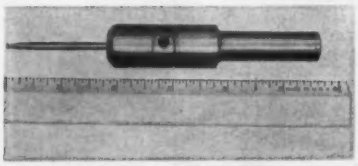
HIGH-POWERED
PRECISION
SURFACE
GRINDERS

MATTISON MACHINE WORKS
ROCKFORD, ILLINOIS

around a standard base. With the adapter, unit can be placed in any position required.

Weight of adapter is 2¼ lb. Details covered in bulletin LL-3990.

Columbian Vise & Mfg Co, Cleveland 4, Ohio

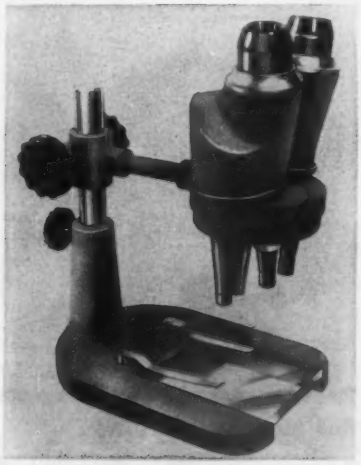


Center-Finding Device Is One-Piece Battery-Powered Unit

Center-finding device called Wiggler is a battery-powered unit that fits into lathe chuck, drillpress, jig bore or other machine and enables operator to accurately locate blueprint coordinates of the workpiece.

The battery-powered electrical contact lights a bulb continuously when work is properly centered. Standard batteries are used for power and changes are made by unscrewing cap. Unit reportedly will not rust and practically never wears out.

Armand Products, Inc, 20 W Morrill Ave, Columbus, Ohio



Low-cost Stereo Microscope Gives 21X and 34X Magnifications

Microscope, designed for lab, shop or home use, is suited for inspections, counting, checking, and assembling. Unit reportedly gives a clear, sharp image, non-reversed on a wide 3-dimensional field. Standard wide-field eyepieces give 21X and

Farquhar Hydraulic Presses engineered for higher profits even on short runs!

THE whole Farquhar engineering-designing effort is directed toward making Farquhar Presses extremely efficient *even on short-run operations.* Farquhar's new triple-acting press with electric magnetic controls is typical of this designing plan. The electric controls of this press provide for fast, easy set-ups and fast, accurate cycle operation—two important advantages that guarantee higher production profits regardless of the size of the run.

We invite you to write for information or ask for our recommendations and proposals.

A. B. FARQUHAR DIVISION
The Oliver Corporation
Press and Special Machinery Department
York 14, Pennsylvania

575-Ton Farquhar Triple-Acting Press with Electric Magnetic Controls. The first of its type with these controls. Advantages: unlimited speed changes—fast cycle time—no cams to adjust—smooth motion to protect expensive dies—4-point blank holder pressure adjustment. For complete facts write for Bulletin A-200.

Special Machinery Built to Your Requirements...

Our staff works with the finest equipment to build your special machines economically. Your inquiry will receive prompt attention.

OLIVER Farquhar PRESSES

Also Manufacturers of Farquhar Conveyors

MACHINING PARTS for industrial lift trucks in ½ the time . . .

The Magic of "Tools"...

In Just 10 Years Living Improves 42%

During the past 10 years production of goods and services in the U.S. increased an astounding 42%. Nearly everybody today has more of everything . . . from homes to haircuts.

But there weren't 42% more people available to create this improvement. It was accomplished with only 18% increase in employment.

The magic: more and better "tools" that have increased individual productivity by 19% since 1946.

Look at the picture above. The machinist is using a new type of machine tool that has increased his output, not just 19%, but up to 50% or more. With it he slots, splits and shapes over 100 different parts for industrial lift trucks—in ⅛ to ½ the time formerly required with other types of machine tools.

More widespread use of newer, better tools like this new DoALL Contour-matic band machine is the only path to continuously greater human productivity . . . lower costs . . . and better living for everyone.

Industrial lift trucks help move torrential tonnages of consumer goods to market.

Manufacturers seeking greater production efficiency will find hundreds of machining operations that can be done better, faster and cheaper with DoALL machines. Literature available upon request.

Reprints of this series on economics available for your employees.

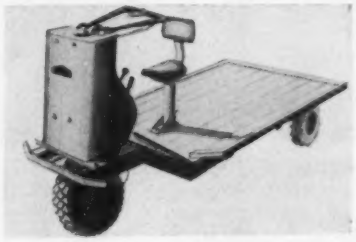
FREE DEMONSTRATIONS of DoALL band machines, surface grinders, lapping machines and gaging equipment available at your plant without obligation. Call DoALL locally or write.

The DoALL Company
Des Plaines, Illinois
38 Local Sales-Service Stores E-53

34X magnifications. Focusing is of helical rack and pinion type with large knob for fine adjustment.

Working distance up to 3 in. allows inspection of relatively large pieces. Interpupillary distance is adjustable. Price is $99.50 fob Barrington, NJ.

Edmund Scientific Co, Barrington 17, NJ

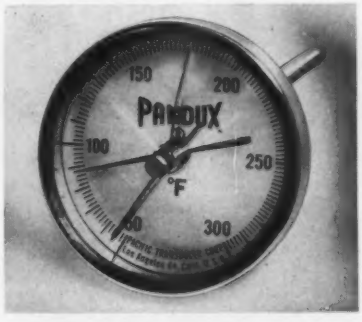


Lightweight Motor Truck Has 3500-lb Pulling Capacity

Gasoline-powered Multiton-Excelsior consumes 1 pt of fuel per hr, has 1500-lb capacity, low bed for easy loading, and can be used to haul loaded trailers.

Unit has three speeds, forward and reverse, three-wheel brakes, pneumatic tires. Price is $645 fob.

Stokvis-Edera & Co, Port Washington, NY



Stem Thermometer Has Maximum And Minimum Indicators

Thermometer features two following pointers that will indicate the max and min temperature reached since the last reading. Pointers are manually set against the high and low sides of the indicating pointer by means of knob. The following pointers will remain at the extreme temperature reached until they are manually reset.

Thermometer is made of stainless steel, has large easy-to-read dial, and

Put HOWELL in Your Product Picture

...and gain the

PLUS values in power

that count!

Are you selecting punch press motors that must "live in" and like the hot spots high up under factory roofs? Want a motor that's built to fill the constant stop-and-start requirements of heavy-duty machine tool service, yet be as good looking as tomorrow's most streamlined and automated machines? Then specify Howell, as machine tool builders and plant engineers throughout the metal working industry have been doing for years. Among many good reasons are these:

EXTRA DEPENDABILITY that challenges the years. Howell's new principle of heat-source ventilation . . . double sealed bearings . . . tough rolled steel frames and precision fitted cast iron end plates . . . these and many more are plus values that *count!*

AN UNSURPASSED REPUTATION for engineering excellence and quality manufacture . . . built up by Howell in over 40 years of serving industry's motor requirements.

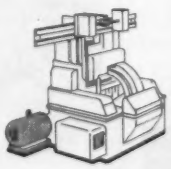
TOPS IN APPEARANCE. No other industrial motors have such smooth, unbroken contours . . . without a fin or rib to mar their looks or catch dust deposits.

Howell makes virtually every type of AC industrial motor, fractional and integral to 300 hp, in all standard enclosures, in rerated and non-rerated frame sizes, also a wide range of gearmotors and brake motors.

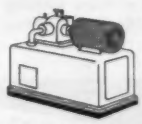
among leading machine tool manufacturers who use Howell motors are these:

The Cross Co. • E. W. Bliss Co. • Warner-Swasey Co.
Snyder Tool and Engineering Co. • The Carlton Machine Tool Co.
The Cincinnati Milling Machine Co. • Sundstrand Machine Tool Co.

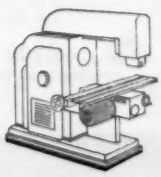
GRINDERS



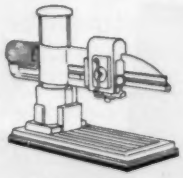
LATHES



HYDRAULIC SYSTEMS



MILLING MACHINES



RADIAL DRILLS

A Howell sales engineer can give you valuable assistance on any motor application. Wire or 'phone collect . . . or drop us a line . . . you'll get prompt action. Howell Electric Motors Co., Howell, Michigan.

HOWELL motors

. . . precision built for industry since 1915

HOW MUCH DO YOU REALLY PAY FOR MILLING CUTTERS?

Hidden costs make inserted blade cutters more expensive than you think!

HERE'S PROOF!

One piece Carbide Tipped cutters have many advantages over inserted blade cutters-better finishes . . . more rigidity . . . closer tolerance milling . . . and one piece safety.

Now here is *proof* that solid cutters also save money hour after hour . . . day after day. Don't be fooled by the "do-it-yourself" replacement blade cutters-they're more expensive than you think.

NELCO Cutter Number	TOTAL COST NELCO Solid Tipped Cutter	Replacement Blade Cutter	COST Equivalent Replacement Blade Cutter	COST of set of Replacement Blades*	REMARKS
6104S	31.00	A	75.00	18.00*	Cost of Complete do-it-yourself cutter and two sets replacement blades $111.00 + replacement and grinding. Cost 3 NELCO Cutters $93.00.
14112F	140.00	B	336.00	84.00*	Cost of Complete do-it-yourself cutter and two sets of replacement blades $504.00 + replacement and grinding. Cost 3 NELCO Cutters $420.00.
12206-1	50.50	C	116.00	40.48*	Cost of Complete do-it-yourself cutter and one set of replacement blades $156.80 + replacement and grinding. Cost of 2 NELCO Cutters $101.00.
10306-½	37.00	D	129.00	33.12*	Cost of Complete do-it-yourself cutter and three sets of replacement blades $228.36 + replacement and grinding. Cost of 4 NELCO Cutters $148.00.
10108F	86.00	E	292.00	102.58*	Cost of Complete do-it-yourself cutter and four sets of replacement blades $702.32 + replacement and grinding. Cost of 5 NELCO Cutters $430.00.

*Figures above do not include removing old blades, inserting new blades and grinding.

FIRST COST IS LAST COST with a NELCO one piece Carbide Tipped Cutter: No expensive downtime to remove, replace and regrind inserted blades. Every NELCO cutter is ready to use-without delay . . . without added "hidden costs!" A spare NELCO cutter costs far less in every way!

Send today for the New Nelco Catalog showing over 700 carbide tipped cutting tools.

NELCO TOOLS

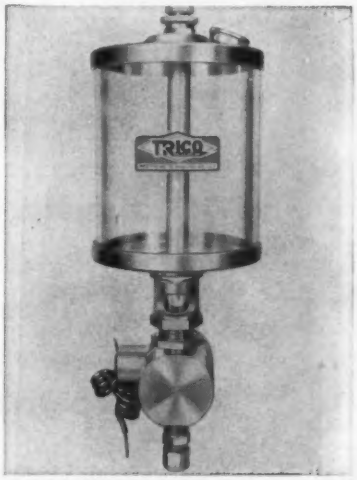
For that EXTRA Edge in Production!

Nelco Tool Co., Inc. • Manchester, Conn.

NEW SHOP EQUIPMENT

has a bi-metallic-type direct drive. It reportedly is accurate to 1% over entire scale, is available in 7 ranges (F or C), and comes with either 2 or 3-in. face, with stainless stem in any length from 3 to 86 in.

Pacific Transducer Corp, 11836 W Pico Blvd, Los Angeles 64, Calif

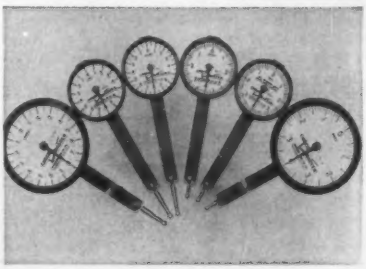


Gravity-Feed Oilers Eliminate Dry Starts

Special reservoir built into the Kwik-Flush oiler automatically floods bearing with a fixed amount (approx 18 oz) of lubricant the instant the oiler valve is opened. Following flushing cycle, lubricant is fed drop by drop at any required rate, then stores up oil for next flushing cycle while machine is idle.

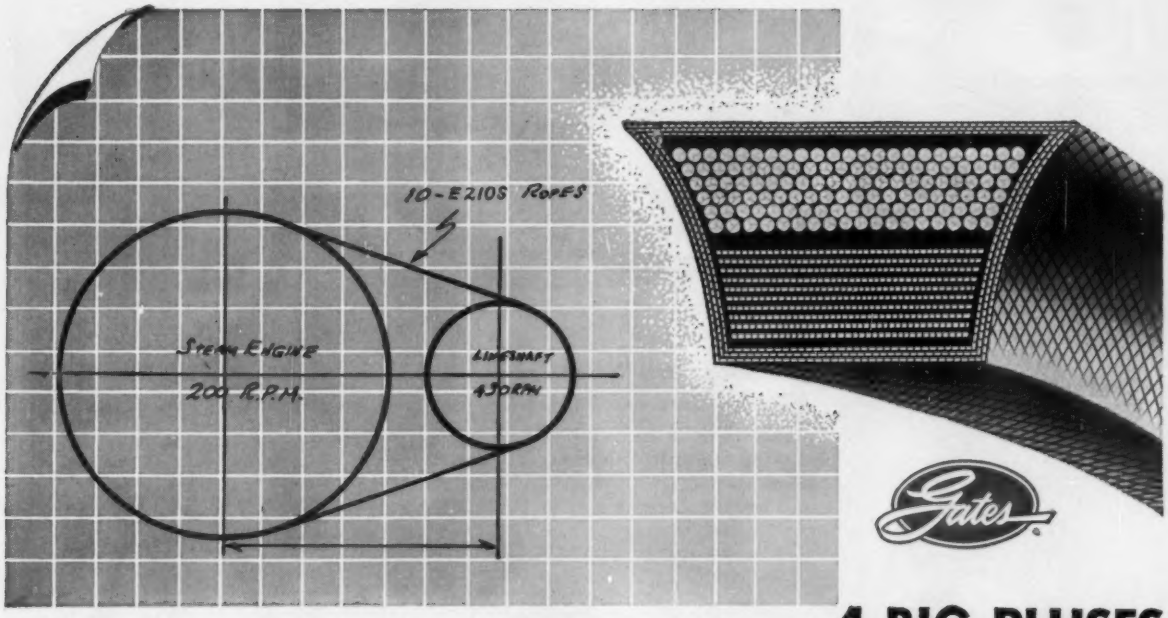
Units are available in 10 oz, 1 pt, 1 qt, and 2½-qt capacities, with manual or electric solenoid shutoff valves. Details in bulletin 38.

Trico Fuse Mfg Co, 2948 N 5th St, Milwaukee 12, Wis



Indicating Gages Are Offered In Six Models

Test indicator called Check Master, reported to respond to dimensional variations of 0.000020 in., is available



MORE HP DELIVERED PER $ INVESTED

On any new drive design—where you have limited space or you need to keep weight down—here is an important fact that can save you money:

A Gates Super Vulco Rope drive will deliver more horsepower per dollar invested than any standard V-belt drive.

Actually, the greater load carrying capacity of Super Vulco Ropes cuts down the number of belts required (5 Super Ropes do the work of 7 standard belts) . . . thus reducing the width of sheaves.

Sheaves with fewer grooves not only cost less, they weigh less, and take up less room—advantages that can easily improve the design and lower the overall cost.

A wealth of drive data is quickly available to you. Simply call your nearby Gates V-Belt Distributor (see 'phone book yellow pages) for a Gates V-Belt Specialist. Stocks available in industrial centers around the world. The Gates Rubber Co., Denver, Colorado—*World's Largest Maker of V-Belts.*

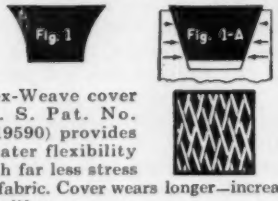
4 BIG PLUSES

✚ *Handles shock loads*

Super-strength cords provide 40% greater horsepower capacity . . . easily absorb heavy shock loads.

✚ *Wears far longer*

Concave Sidewalls (Fig. 1) increase belt life. As belt bends, concave sidewalls (U.S. Pat. No. 1813698) become straight, make uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt . . . longer V-belt life.



Flex-Weave cover (U. S. Pat. No. 2519590) provides greater flexibility with far less stress on fabric. Cover wears longer—increases belt life.

✚ *Provides Static Safety*

High electrical conductivity is built into Gates Super Vulco Ropes for safer drives (in explosive atmospheres).

✚ *Resists oil, heat and weather*

Special rubber compounds with which cords and fabric are impregnated make Super Vulco Ropes highly resistant to heat, oil and prolonged exposure.

TPA 76B

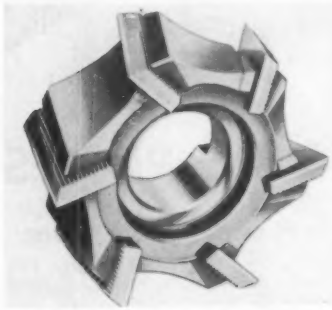
Gates Super Vulco Rope Drives

NEW SHOP EQUIPMENT

in six models, including both regular and non-magnetic types. It can be used on all types of fixtures, with surface-plate setups, and for truing of pieces on machines.

Device is available with 1⅛- or 1¾-in. dials, gradauted in 0.0001, 0.0005, or 0.001 in., with a range of 0.008 or 0.016 in. Also featured is an all-purpose model that provides both a 0.0001- or 0.001-in. indicator, in a single instrument, simply by a change of the contact point.

Standard Gage Co, Inc, Poughkeepsie, NY



Inserted-Blade Shell End Mills Machine Light Metals

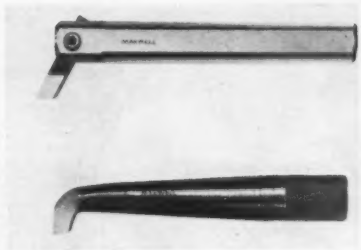
WND Series of HSS-blade shell end mills, designed for machining aluminum and light-metal alloys, is offered in diameters ranging from 3 to 8 in., over-all widths from 1⅝ to 2 in., and in either right- or left-hand cut. Chip pockets are polished for free-flowing chip disposal. All cutters can be provided with corner radii.

Serrated wedges lock cutter body and blades, which can be set out radially in 1/16-in. increments for diameter maintenance. Cutter blades, arbors, and adapters are stocked for the series. Bulletin No. 35.

Goddard & Goddard Co, 12280 Burt Rd, Detroit 23, Mich

Homing device has been added to the Hamilton small-hole precision tapping machine. Device returns the machine spindle to neutral position instantly and automatically when pressure on the feed lever is released. This return to neutral stops rotation of the tap and permits gentle withdrawal through reverse pressure on the feed lever. Application of device extends capacity of machine to work as small a 0.034 in. x 120 and as large as 0.25 in. x 24.

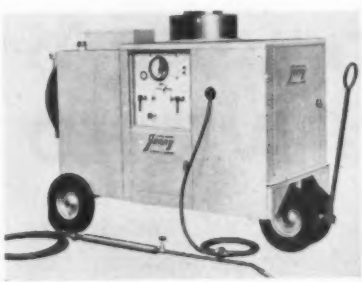
Hamilton Tool Co, 9th St at Hanover Hamilton, Ohio



Maxwell Adds New Line of Boring Bars and Forged Bits

Boring bars made of tool steel are available with four flats and straight or angular square holes and come in standard sizes from ½ to 1½-in. dia. Forged bits range in size fron ⅜- to 1-in.-dia shanks with boring capacity starting at ¼ in. Special designs are available upon request.

Maxwell Industries, Inc, Macedonia, Ohio



Homestead High-Pressure Cleaner Provides 450-psi Pressures

Series 4000 Hypressure Jenny, a portable cleaner, gives any desired cleaning action ranging from 400 gal per hr of cold water at 450 psi up to a mixture of steam, water, and cleaning compound at 325 F. Many combinations of heat, pressure, and water volume, with or without cleaning compound, can be obtained.

Cleaner, offered in 7 models, is also available in a stationary version. Electric-motor or gas-engine pumps are offered, and fuel used can be oil or gas. Bulletin 17-A-56.

Homestead Valve Mfg Co, Coraopolis, Penna

Nylon drill sleeve, the Drill Saver, will break instead of the drill when drill hits hard spot or air hole and stops. Sleeve is cured for hardness, is unaffected by coolants, oil, gasoline or grease, and comes in sizes 1-2, 2-3, and 3-4.

James Products Co, 801 Mentor Ave, Mentor, Ohio

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES

The American Laundry Machinery Co., Rochester, N. Y.
Atlas Foundry Co., Detroit, Mich.
Banner Iron Works, St. Louis, Mo.
Barnett Foundry & Machine Co., Irvington, N. J.
Blackmer Pump Co., Grand Rapids, Mich.
Centrifugally Cast Products Div., The Shenango Furnace Co., Dover, Ohio
Compton Foundry, Compton, Calif.
Continental Gin Co., Birmingham, Ala.
The Cooper-Bessemer Corp., Mt. Vernon, Ohio and Grove City, Pa.
Crawford & Doherty Foundry Co., Portland, Ore.
Empire Pattern & Foundry Co., Tulsa, Okla.
Florence Pipe Foundry & Machine Co., Florence, N. J.
Fulton Foundry & Machines Co., Inc., Cleveland, Ohio
General Foundry & Mfg. Co., Flint, Mich.
Georgia Iron Works, Augusta, Ga.
Greenlee Foundry Co., Chicago, Ill.
The Hamilton Foundry & Machine Co., Hamilton, Ohio
Hardinge Company, Inc., New York, N. Y.
Hardinge Manufacturing Co., York, Pa.
Johnstone Foundries, Inc., Grove City, Pa.
Kanawha Manufacturing Co., Charleston, W. Va.
Koehring Co., Milwaukee, Wis.
Lincoln Foundry Corp., Los Angeles, Calif.
Palmyra Foundry Co., Inc., Palmyra, N. J.
The Henry Perkins Co., Bridgewater, Mass.
Pohlman Foundry Co., Inc., Buffalo, N. Y.
The Prescott Co., Menominee, Michigan
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Sonith Industries, Inc., Indianapolis, Ind.
Standard Foundry Co., Worcester, Mass.
The Stearns-Roger Mfg. Co., Denver, Colo.
Valley Iron Works, Inc., St. Paul, Minn.
Vulcan Foundry Co., Oakland, Calif.
Washington Iron Works, Seattle, Wash.
Dorr-Oliver-Long, Ltd., Orillia, Ontario
Hartley Foundry Div., London Concrete Machinery Co., Ltd., Brantford, Ontario
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• **"MEEHANITE CASTINGS FOR PRESSURE TIGHTNESS" BULLETIN NO. 43**

Write today to Meehanite Metal Corporation, Department 5E, 714 North Avenue, New Rochelle, New York.

MEEHANITE®

This huge casing for an 84" volute pump was cast in four sections in high strength (over 50,000 psi) Meehanite metal.

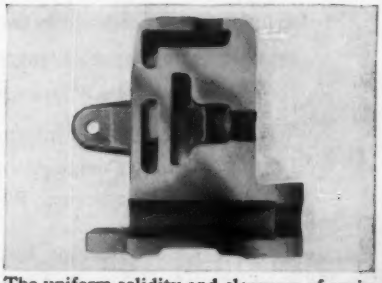
Pressure tight Meehanite castings are uniformly sound and possess high strength values

Meehanite metals provide designers, production men and engineers with a group of dependable materials that possess the superior combination of physical properties required by pressure tight castings used with water, oil, steam, gas and other substances.

The consistent uniformity of the structure of Meehanite metal throughout all casting sections insures excellent performance in service and offers positive freedom from leaks, porous zones and structural weakness.

In addition, Meehanite castings provide high strength values in the order of 55,000 lbs. psi and have a true modulus of elasticity which is important in computing bursting stress.

If you would like to know more about the advantages of Meehanite metal, write today for your free copy of bulletin #43 "Meehanite Castings for Pressure Tightness."

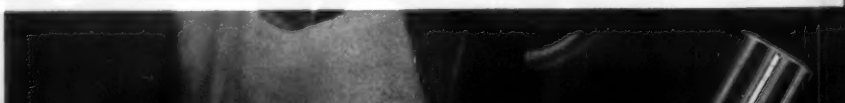


The uniform solidity and closeness of grain through all complex sections are revealed in this cross section of a Meehanite hydraulic valve unit.

MEEHANITE BRIDGES THE GAP BETWEEN CAST IRON AND STEEL®

MEEHANITE METAL

MEEHANITE METAL CORPORATION, NEW ROCHELLE, NEW YORK



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. . . because PRATT & WHITNEY KELLER CUTTERS produce *more* accurately machined pieces per tool and run longer between grinds. The result is lower *tooling costs* than with other cutting tools which may cost less initially, but produce less. Correctly designed, precision manufactured from selected steels and inspected to meet rigidly high P&W standards, they are *quality* from start to finish! Now produced in both straight and taper shank types in a wide range of lengths and diameters. Available from stock at the P&W Branch Office near you.

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NEW SHOP EQUIPMENT

Mist Generator Pin-Points Coolant to Cutting Area

Arrow Jet-Mist generator, designed for easy assembly to all types of machine tools, pin points air-liquid coolants or air-oil lubricants directly to cutting area. Unit is suited for permanent grinding, turning, boring, milling, sawing, drilling, tapping and other continuous operations.

Installation uses machine tool sump pump with ¼-in. NPT air line connection for single or multi-jet mist spray. Pressure regulators and pressurized coolant tanks are available for machines without sump or sump pump. Bulletin MG-1056.

Arrow Tools, Inc, 1996 S Kostner Ave, Chicago 23, Ill

Precision Torque Control Available for Thor Tools

Thor Uni-Tork clutch attachment is available for company's air and electric screwdrivers and nutsetters. Torque adjustment is set on the outside of the attachment, and the clutch disengages instantly and completely when preset torque is reached. Torque setting reportedly holds indefinitely, assuring uniform tightness. Adjustment ranges from 10 to 100 in.-lb torque.

Thor Power Tool Co, Aurora, Ill

MEEHANITE METAL

MEEHANITE METAL CORPORATION, NEW ROCHELLE, NEW YORK

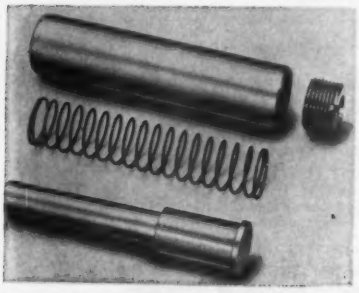
NEW SHOP EQUIPMENT

Magnifying Inspection Device For Parts Up to 3-in. Diameter

Device known as the Spectifier provides a reliable, high-speed method of inspecting finish and other details on machined parts and similar work. Both eyes can be used and inspection can be made at all angles.

Unit needs no focusing devices and no holders are required for material being inspected. Uniform lighting is reportedly produced by 25-watt lamp. Price is $23.50, boxed, fob.

Eastern Machine Screw Corp, New Haven, Conn



Single-Acting Cylinder

Unit can be used both as a kicker in pressroom installations and as a disappearing back gage pin facilitating loading and unloading of stampings.

Cylinder measures 3½ in. plus stroke in length, 1¼ in. in dia, and can be actuated by a 30-psi airline. Strokes most frequently used are 2½, 4½, and 6 in.

Sahlin Engineering Co, PO Box 289, Birmingham, Mich

Shearcut Push Broaches Available In Stock Sizes up to 1 in.

Shearcut dual-purpose push broaches are produced as stock items, and can be used as conventional push broach-

. . . because they Run Longer!

. . . PRATT & WHITNEY END MILLS give you the lowest tooling cost for every finished workpiece. Correctly designed, carefully manufactured from selected steels, expertly heat treated, precision ground and rigidly inspected, Pratt & Whitney End Mills have *everything* it takes to produce finer finishes in less time and at lower costs. A complete line of types and sizes for every job requirement is available from stock at the P&W Branch Office near you.

Send now for completely descriptive literature.

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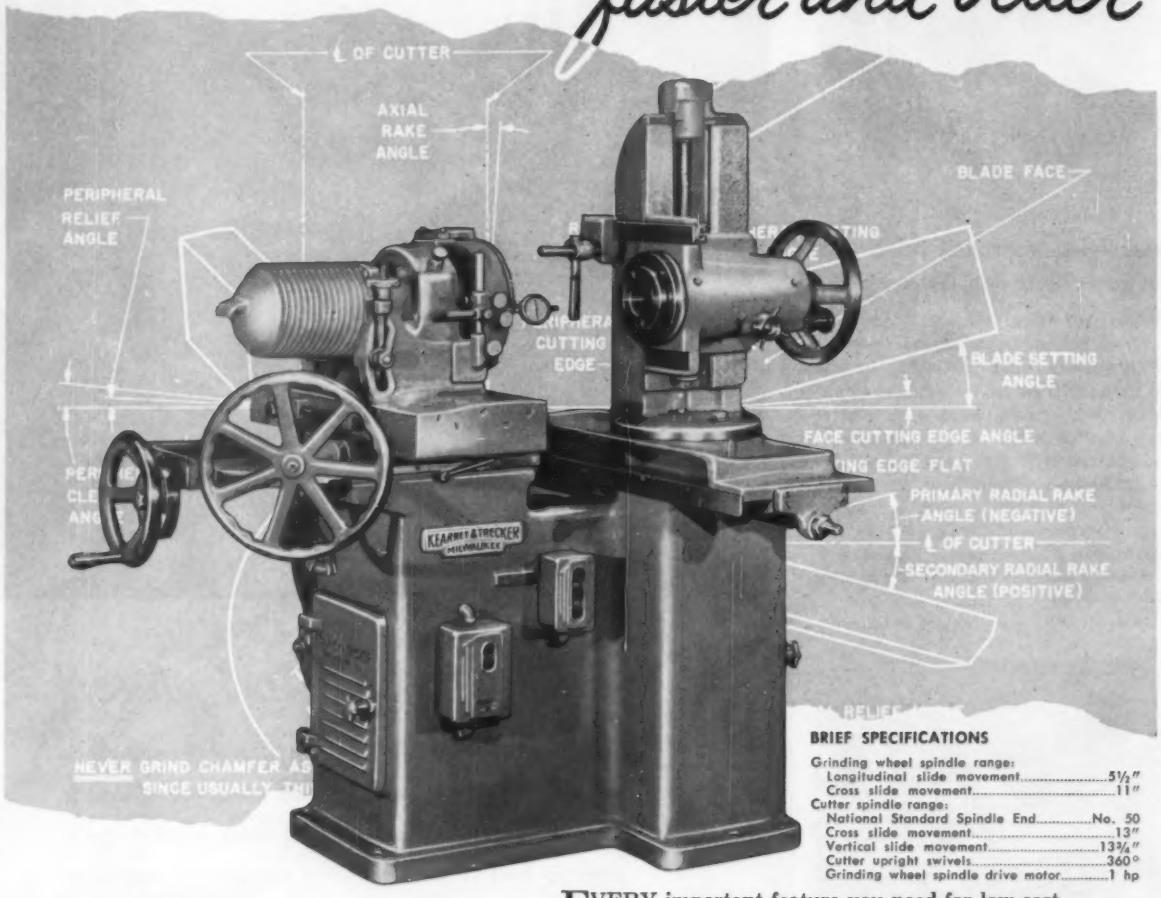
for sharpening carbide face mill cutters *faster and better*



BRIEF SPECIFICATIONS

Grinding wheel spindle range:	
Longitudinal slide movement	5½"
Cross slide movement	11"
Cutter spindle range:	
National Standard Spindle End	No. 50
Cross slide movement	13"
Vertical slide movement	13¾"
Cutter upright swivels	360°
Grinding wheel spindle drive motor	1 hp

KEARNEY & TRECKER CUTTER GRINDERS

handle all types of face mill cutters up to 24" in diameter. Accurate to 0.0002"

EVERY important feature you need for low-cost, efficient sharpening of carbide and H.S.S. face mill cutters are built into these Kearney & Trecker heavy-duty precision Cutter Grinders.

Handily located controls simplify operation. Graduated dials facilitate setups. Spindle flywheel helps maintain 3400 rpm constant speed during grinding. A jeweled-bearing dial indicator is furnished for checking finished cutter accuracy.

Three-inch to 7" dia. face mills attach to style "C" arbors and mount on the cutter spindle head. Cutters 8" to 24" dia. bolt directly to spindle nose.

For further Kearney & Trecker Cutter Grinder details request Bulletin No. G-10A. See your nearest representative or write Kearney & Trecker Corp., 6786 W. National Ave., Milwaukee, Wis.

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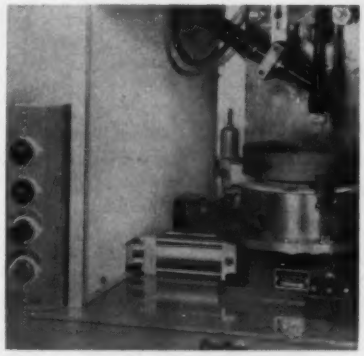
NEW SHOP EQUIPMENT

es in punch presses, hydraulic presses and lathes. They can also be used as rotary broaches in such operations as finishing of long holes.

Tools have mutiple spiral flutes and are designed to remove from .005 to .015 in. of stock in hole finishing operations. They are easily resharpened on standard tool grinder.

Stock sizes range from ⅛ to 1 in. in increments of 1/32 in. Semi-finished blanks are also available.

Shearcut Tool Co, 7045 Darby Ave, Reseda, Calif



ELECTRIC-MOTOR CORES are welded on automatic machine which consists of a standard dc welder and separate enclosure that houses torch, indexing table, and automatic and regulatory controls. Six evenly spaced linear welds are made. Operator secures work on index table, and all welding operations are handled automatically. Operator needs no welding experience — *Automatic Methods, Inc, 802 W Grand St, Elizabeth, NJ*

German Cylindrical Grinder Has Six Grinding Speeds

Cresta Universal Model 508 cylindrical grinder has a 7⅛-in. swing and is available with either 12 or 20 in. between centers. Machine is hydraulically controlled and permits toolroom or production grinding of outside or inside cylindrical diameters.

Grinding head is supplied with or without swivelling mechanism. With the swivels, steep angle tapers can be produced by longitudinal grinding. Speed of the grinding table can be regulated over the range of 4 to 300 ipm. Grinding speeds range from 125 to 610 rpm.

Available accessories include dressing attachments, dial indicator measuring devices and a micrometer table

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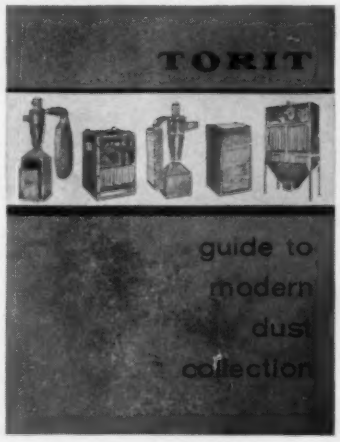

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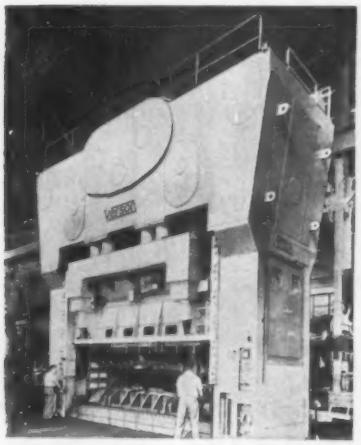
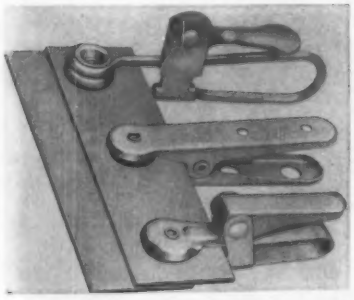
311 Walnut Street, St. Paul 2, Minn. Dept. 406

stop. A manually operated machine, model 518, available at a lower price, has many of the features of the automatic model.

Imported by Eric R Bachmann Co, Inc, 27-11 41st Ave, Long Island City 1, NY



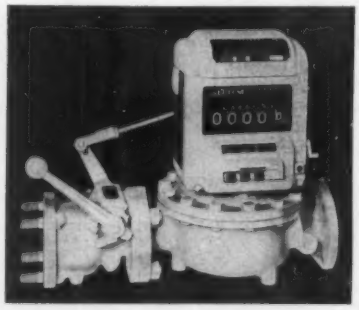
TRUCK BODY PARTS are blanked and drawn on 2500-ton-capacity double-action mechanical press which stands over 38 ft high and has a bed and ram measurement of 90 x 208 in. Featuring a rapid tool change system, the press has a standard speed of 7 spm—*Verson Allsteel Press Co, 1355 E 93rd St, Chicago 19, Ill*



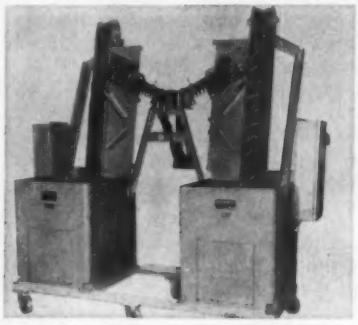
INDUSTRIAL CLAMPS known as Yates clamps, used for dipping, flange work, edge work, and bench or wall use, come in four types: flat spring-steel clamp, 5/32-in. capacity; spring grip clamp, 5/16 in.; spring wire clamp with cam lever lock, 1¾ in.; and conveyor clamp with saw-tooth jaws and a capacity of ¼ in.—*Wedgelock Corp, Dept 1-R, 5446 Satsuma Ave, North Hollywood, Calif*

Cleaning machine, the Super Tumblast airless abrasive-blast cleaning machine, for cleaning sand, scale and oxides from metals has an operating load capacity of 14 cu ft. Operation and construction is similar to 28-cu-ft model previously described (AM—Jun 4 '56, p192).

Wheelabrator Corp, Mishawaka, Ind



LIQUID METER, designated Repeating Auto-Stop, delivers same quantity of liquid each time valve is opened, shutting off automatically when preset quantity is reached. Unit handles many types of industrial liquids, is suited for batching and blending operations where same formula is often repeated, and features pushbuttons that enter quantity settings on the register. Available in 1, 1½, 2 and 3-in. sizes—*Neptune Meter Co, 19 W 50th St, New York 20, NY*

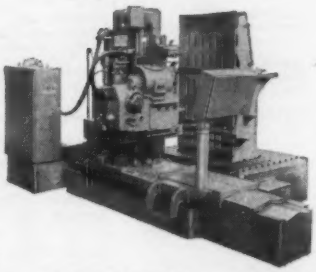


TWO MODEL 2200 FEEDERS, mounted together, combine their delivery chutes to feed two different-sized parts to an automatic drilling machine. Each feeds a stream of oriented parts into a chute where they are subdivided by shuttle device into two chutes, providing four streams—*Feedall, Inc, Willoughby, Ohio*

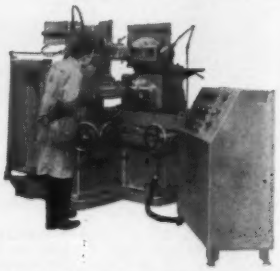
Small-diameter die springs, Assortment No. 40, consist of 40 different wire sizes in 8 spring diameters ranging from 3/32 to ½ in. Springs are 10 in. long with open ends.

Producto Machine Co, 990 Housatonic Ave, Bridgeport 1, Conn

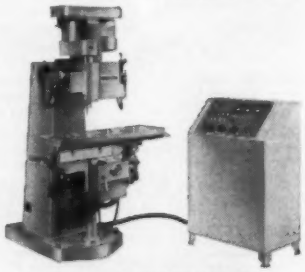
A P&W Tracer-Controlled MILLER FOR EVERY JOB



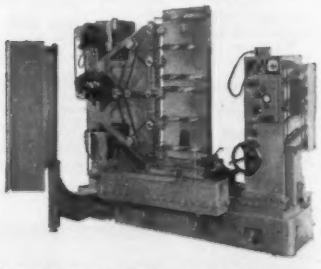
KELLER TYPE BG-21 . . . a powerful, versatile machine in a range of sizes from 5′ x 2½′ to 10′ x 4′, in single and 2-spindle models.



KELLER TYPE BL . . . a compact, powerful Tracer-Controlled Miller for work within the range of 36″ x 20″. With all new Keller features. Single and 3-spindle models.



VELVETRACE® MILLING MACHINE . . . duplicates the finest detail with extreme precision. New, non-contacting tracer control cannot damage the softest, most fragile 3-dimensional models.



AUTOMATIC DUPLICATION MACHINES . . . automatically reproduces original forging dies and glass or plastic molds with remarkable precision and detail. Two versions, one for molds, one for dies, with 1, 2 or 4 spindles.

PHOTO COURTESY OF ALUMINUM COMPANY OF AMERICA

To machine the WORLD'S LARGEST DIE,

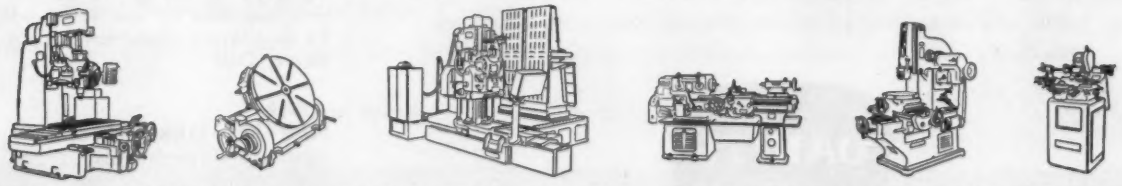
ALCOA chose the Keller . . .

. . . AUTOMATIC TRACER-CONTROLLED MILLING MACHINE

Consisting of two halves, each weighing 30 tons, this is the world's largest closed die block. Designed to forge aluminum backbones of fuselage and wing structures for the new multi-jet Martin SeaMaster, this giant die was produced on a P&W Keller BG-22 at the U.S. Air Force Heavy Press Plant operated by Aluminum Company of America.

Chances are that your own workpieces aren't as large as this die, but there is a Pratt & Whitney Keller Automatic Tracer-Controlled Miller for *every* worksize requirement. *Every* Keller Machine offers the same important advantages: fast, accurate reproduction of complex 3-dimensional shapes, extreme versatility and an overall ability to produce highest work quality economically. These advantages will also make Keller *your* first choice for a wide variety of die, mold and other hard-to-handle 2- and 3-dimensional milling jobs. Write now for complete information.

Pratt & Whitney Company, Incorporated, 11 Charter Oak Boulevard, West Hartford, Conn.



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When tough finishes resist your present stripping methods, you may need help on some of these problems:

1 How to strip oil-base paints . . . synthetic enamels . . . alkali-resistant plastics . . . resin-base paints . . . japans . . . wrinkle finishes . . . nitrocellulose lacquers . . . alkyds . . . phenolics . . . ureas.

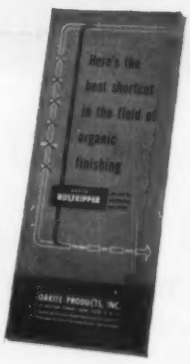
2 How to strip zinc chromate primers without etching aluminum.

3 How to strip paint from vertical surfaces and undersurfaces where thin-bodied strippers run off without doing their work.

4 How to strip metal parts that are too large to be soaked in tanks.

5 How to strip paint, pigment residues, phosphate coatings and rust in one operation.

6 How to strip paint from rejects, conveyor chains, racks and hooks in continuous operation.



Oakite has more than a dozen fine stripping materials for these and similar jobs.

FREE For information on problems 1, 2, 3 and 4 ask for a copy of "How to STRIP PAINT". For more on problems 5 and 6 ask for "Here's the best shortcut in the field of organic finishing". Write to Oakite Products, Inc., 24 Rector St., New York 6, N. Y.

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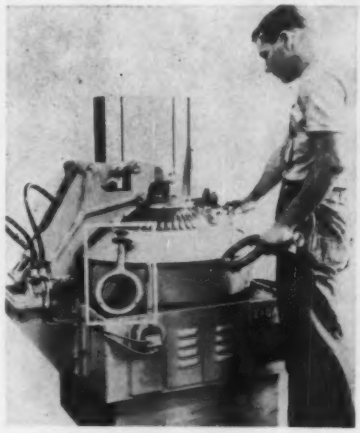
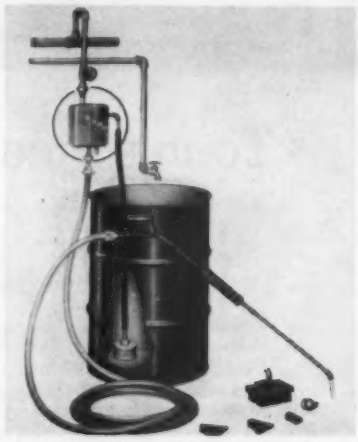
NEW SHOP EQUIPMENT



CAST-IRON GAS BURNERS are machined on radial drill, which drills a circular hole pattern on the part. Total of 68 holes (34 simultaneously in two passes) are drilled at a 45° angle. Operator loads part on air-actuated clamp on an index table. Drillhead is fed automatically; when drills retract, operator indexes part to drill other half of circle—*Zagar, Inc, Lakeland Blvd, Cleveland 23, Ohio*



HYDRO STEAM CLEANER, Model S-809, requires only ¾-in. valved steam outlet for power to pick up, mix, heat, and deliver cleaning solution in driving spray at rate of 190 gal per hr. Unit, operated by one valve, weighs 15 lb—*Clayton Manufacturing Co, El Monte, Calif*

Steel key stock, cold-finished in square and rectangular forms, is electro-galvanized for improved corrosion resistance and easy handling. Layer of plated zinc prevents rust and distortion of bars.

De Van Johnson Co, 500 Rathbone Ave, Aurora, Ill

For quickest service in solenoid valves, write for Skinner's Nationwide Stock List

The Skinner Nationwide Stock List covers the most universally applied Skinner Solenoid Valves for air and hydraulic service. All the valves listed are carried by every Skinner Stocking Distributor in the U. S. From his stock, your own local distributor can quickly meet your requirements. So for your own convenience, we urge you to write for this nationwide stock list of Skinner Solenoid Valves.

Skinner Stocking Distributors are located in all key industrial areas. If you have a solenoid valve problem, talk to the one nearest you. Tell him your requirements in regard to port sizes and locations, voltages, pressures, temperature conditions, capacities and mountings. Let him show you how easily he can select the valve you need.

For complete information on Skinner's line of exceptionally long-life 2-, 3- and 4-way valves, write us or contact a Skinner representative. Write Dept. 303.

Skinner Solenoid Valves are distributed nationally

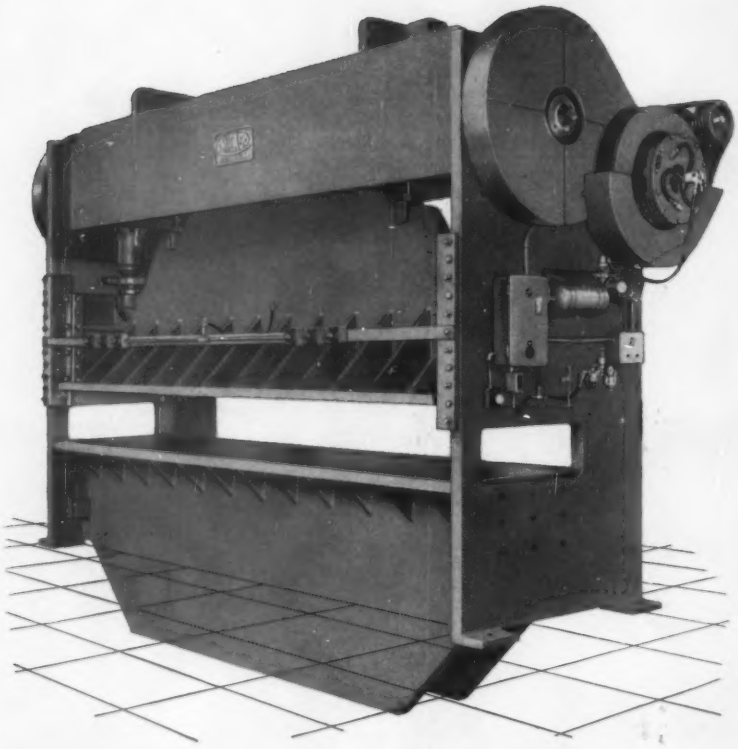
SKINNER ELECTRIC VALVES

SKINNER ELECTRIC VALVE DIVISION

NEW BRITAIN CONNECTICUT

105 EDGEWOOD AVENUE

E CREST OF QUALITY



CHICAGO DREIS & KRUMP

PRESSES
STRAIGHT-SIDE TYPE

large die area
capacities up to 400 tons

This is a typical model of CHICAGO straight-side-type presses used for multiple punching, notching, and trimming operations. This press with a die area of 48 inches by 198 inches has a capacity of 200 tons.

Complete recommendations for any job on request.

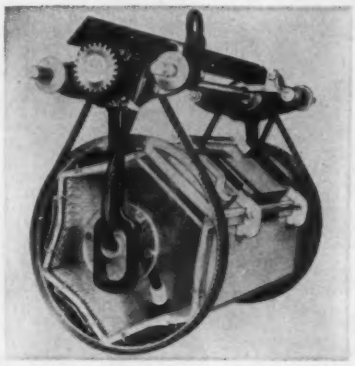
6674

CHICAGO DREIS & KRUMP

Press Brakes • Straight-Side-Type Presses • Press Brake Dies
Hand and Power Bending Brakes • Special Metal-Forming Machines

DREIS & KRUMP
MANUFACTURING CO.
7434 South Loomis Boulevard, Chicago 36, Illinois

NEW SHOP EQUIPMENT



BARREL PLATING CYLINDER, driven by a standard cogged V-belt which eliminates uses of a series of gears, has no moving parts, so that wear and maintenance are greatly reduced. Barrel is designed for total submersion during plating process, and is available in Plexiglas, Melamine, and Tempron in all standard models and sizes. It can be interchanged with all present types of Mercil equipment — *Hanson-Van Winkle-Munning Co, Church St, Matawan, NJ*

Welding electrode, Jetweld LH-70, is an iron-powder, low-hydrogen type for general purpose welding of all steels with high currents and for welding crack-sensitive steels and steels producing porosity in weld metal. Iron powder reportedly results in 10 to 30% higher welding speeds. Available in sizes from ⅛ to ¼ in., it is classified as ASW E-6016.

Lincoln Electric Co, Box 3115, Cleveland 17, Ohio

Zinc phosphating compound, Crys-Coat LT, for use at low temperatures in spray washing machines, converts the surface layer of steel into a zinc phosphate coating weighing from 150 to 300 mg per sq ft. Designed for application in 5-stage washing machines, compound is effective at temperatures between 120 and 140 F, and presents a minimum of sludging difficulties.

Oakite Products, Inc, 124 Rector St, New York 6, NY

Detachable abrasive tank that minimizes machine maintenance and abrasive refill time is now standard equipment on the Gyro-Matic 21 automatic lapping machine.

Spitfire Tool Co, 2931 N Pulaski Rd, Chicago 41, Ill

Mr. V. N. Agather, Vice President of Production at La Consolidada, S. A., Mexico, Manufacturers of Malla-Lac—Concrete Reinforcing Wire Mesh.

—he helped make it possible with Sciaky Resistance Welding Techniques

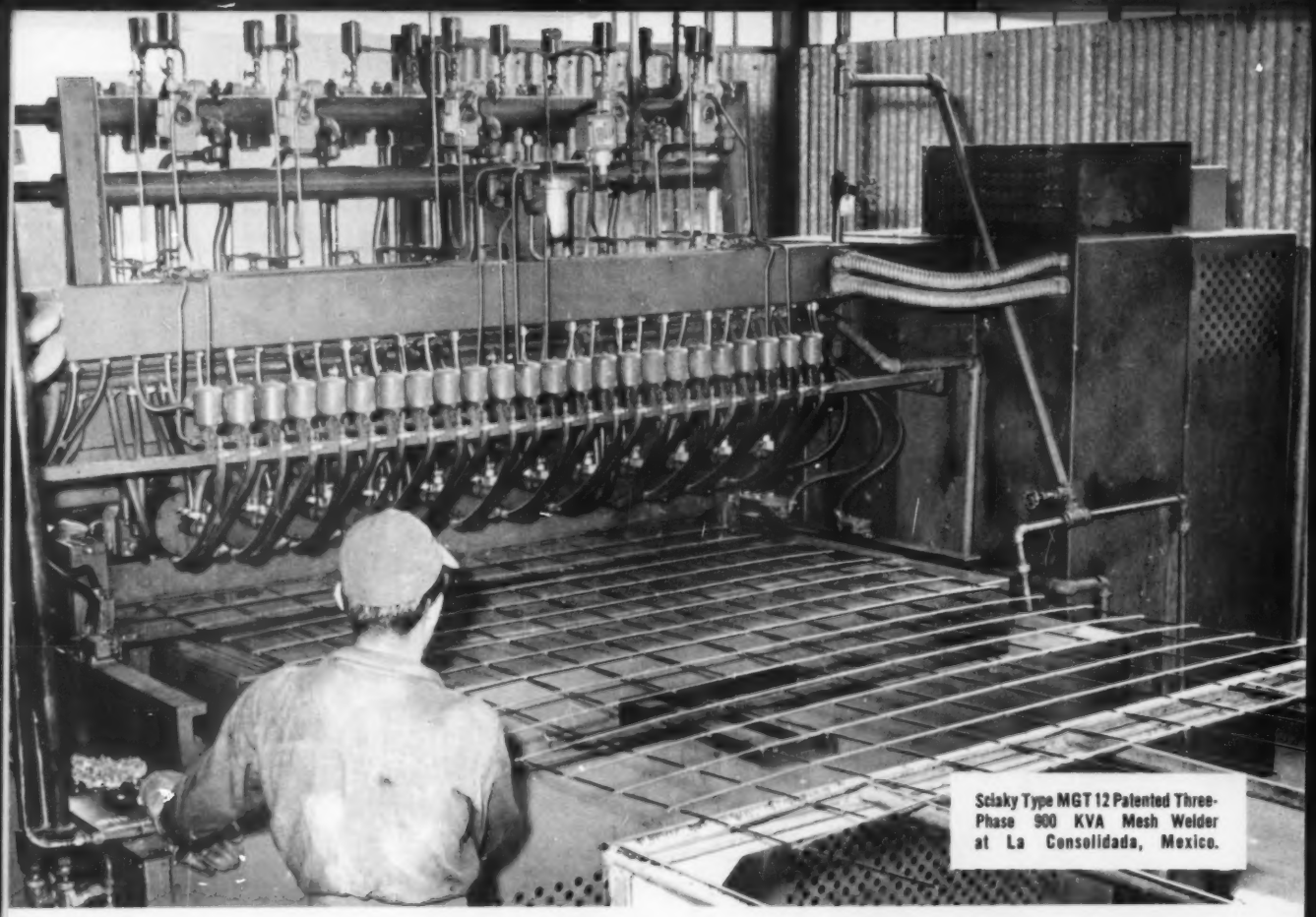
Not only are Mexican swimming pools made with La Consolidada concrete reinforcing wire mesh, but office buildings, commercial structures and private homes as well. Critical shortages of lumber and fabricated structural members in Mexico force the extensive use of reinforced concrete construction.

As the leading Mexican manufacturer of steel wire and wire products, industrial fasteners and merchant bar products, it was natural for La Consolidada to become the first to introduce resistance welded wire mesh for concrete reinforcing.

In their need for a production process that would satisfy their particular complex requirements, La Consolidada turned to Sciaky Resistance Welding Techniques exclusively. Because Sciaky Resistance Welding Techniques are designed to put the profits back into manufacturing! Turn the page for more information on how La Consolidada does it.

SCIAKY

There are Sciaky plants in Chicago, Paris and London, as well as an Application Research Center in Los Angeles, California



Sciaky Type MGT 12 Patented Three-Phase 900 KVA Mesh Welder at La Consolidada, Mexico.

La Consolidada Offers 32% Savings in Steel to Building Construction with Concrete Reinforced Wire Mesh

***Sciaky Resistance Welding Techniques* used exclusively to introduce concrete reinforcing wire mesh to Mexico**

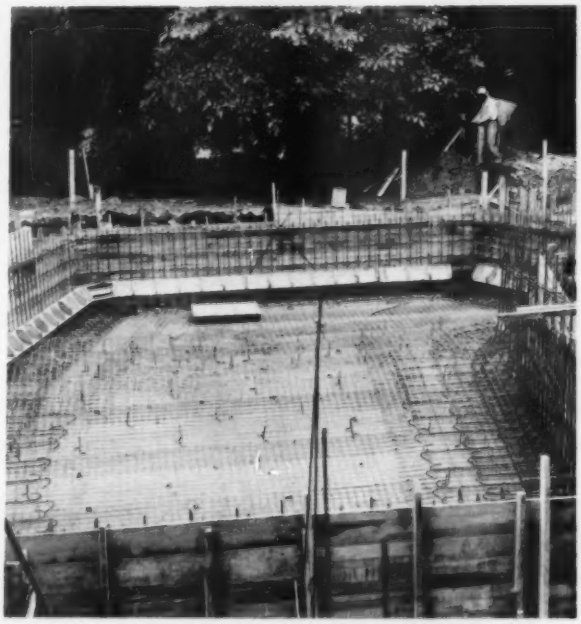
La Consolidada's wire mesh, called Malla-Lac, has received immediate, overwhelming acceptance and future production is already sold out. Much of this success is due to production methods and Sciaky equipment tailored to specific needs:

1. **Versatility to provide range of mesh and wire sizes.**
2. **Capacity to match needs.**
3. **Simplicity of operation and maintenance.**
4. **Dependability in heavy duty operation.**
5. **Lowest cost to put equipment in production.**
6. **Ability to get service in Mexico.**

Sciaky resistance welding techniques and equipment satisfy all of these requirements. It enables La Consolidada to sell Malla-Lac at a price competitive to reinforcing bar. It enables La Consolidada to produce a product of the quality necessary to building construction.

If *you* fasten metal products together to fabricate your products, take advantage of Sciaky Resistance Welding techniques—like La Consolidada does!

Further data is given in the publication "Resistance Welding At Work", Vol. 5, No. 2. Write for your copy.



La Consolidada Concrete Reinforcing Wire Mesh As Used In Construction of Swimming Pool.

Sciaky Bros., Inc., 4930 West 67th Street, Chicago 38, Ill., POrtsmouth 7-5600

SCIAKY®

Plastic laminate, Textolite 11572, is a paper-base laminate recommended for electronic applications using high voltage at radio frequencies. It withstands exposure to common degreasing solvents, and has cold fabricating quality that eliminates dimensional changes resulting from combination of heat and punching stresses. It punches cleanly in thicknesses up to ⅛ in.

General Electric Co, Laminated Products Dept, Section PRL-2, Coshocton, Ohio

Spherical roller bearings, SKF Type C, have been redesigned to provide 25 to 50% increased capacity, size for size, and up to 3½ times more service life. Available in bearings of 140-mm (5.5118-in.) OD and larger, devices have improved lubrication method which offers center instead of side lubrication.

SKF Industries, Inc, Front St & Erie Ave, Philadelphia 32, Penna

German Automatic Cutoff Saw Cuts at Speeds Up to 1650 fpm

Model KS 60 automatic circular cutoff saw, manufactured by Gutberlett in West Germany, has saw blades of 8¾- or 10½-in. dia, and is capable of cutting solid material up to 2⅜-in. dia and tubing up to 3⅛-in. dia. Machine has max automatic cutoff length of 15¾ in.

Chucking of material, feed of bar, and feed of saw blade are hydraulically controlled; saw-blade feed is sensitive to cutting pressure and is automatically adjusted resulting in long blade life. Gear changes permit choice of speed in 3 ranges from 39 to 1650 fpm. Quick changeover from automatic to single-cut operation is provided.

Imported by Eric R Bachmann Co, Inc, 27-11 41st Ave, Long Island City 1, NY

Molybdenum Disulfide Compounds

Molyglyde 256-V incorporates moly in a volatile base. Applied in the same manner as a light viscosity lubricant, compound is conveyed to points to be protected; it then volatizes, leaving the moly to function as a dry lubricant.

Molyglyde 156-P is a multi-duty lubricant designed for general use where heat above 300 F is not a factor.

Vanguard Solid Lubricants, Inc, 57 E 73rd St, New York 21, NY

an ACCO product

Acco Registered® Sling Chains

NEW!
Shaped Section Master Link
Holds its form under loads up to 18% greater.
NEW!
Accoloy X-Weld 125 Chain
Welds as strong or stronger than alloy material. Welded area 2¼ times conventional size area.
*Pat. No. 2763768

New X-weld Chain and New Master Link give added strength, safety!

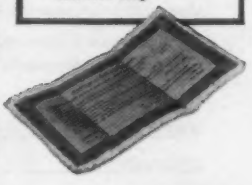
• The best has been made even better! ACCO *Registered* Sling Chains, recognized everywhere as the finest sling chains on the market, have now been made still stronger and safer by incorporating ACCO's great new Accoloy X-weld 125 chain and ACCO's new Shaped Section Master Link.

The Accoloy X-weld 125 chain is non-kinking. Each link has an oversize welded area with welds of full alloy strength. This means extra ruggedness and longer service life. Chain is identified at 5-foot intervals by tape markers reading "ACCO X-Weld Pat. No. 2763768." The new Shaped Section Master Link weighs no more, but it withstands deformation under loads up to 18% greater than a conventional round section can.

Next time you buy sling chains, get ACCO *Registered* Sling Chains—they are better than ever! For full details, call your ACCO *Registered* Distributor—or write our nearest District Office.

WHAT "ACCO REGISTERED" MEANS

1 The best material
2 Unit safety factor (on bodies, rings, links, hooks)
3 Proof test of complete sling to twice the working load limit
4 Actual field service test of each design
5 Metal identification ring on each sling
6 Signed Registry Certificate with each sling

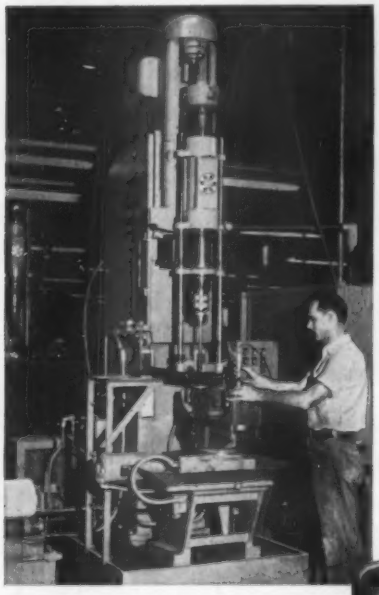


ACCO
American Chain Division
AMERICAN CHAIN & CABLE
TRADE MARK
York, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

plus Rings Links Hooks

WHY Emerson Electric MICROHONES Laminated Steel Rotors

The Emerson Electric Manufacturing Company is constantly searching for the best possible processing methods. Working with Micromatic engineers on problems encountered in processing shaft holes in their laminated steel rotors, Emerson Electric found that Microhoning would provide much higher production quality while lowering processing costs. The following Microhoning benefits are now obtained:



Model 728 Hydrohoner with automatic Microsize, Microdial and two station rotary indexing fixture. Hole Tolerances: Diameter .0002 inch, straightness and roundness .0001 inch.

CUT REJECTS
With former processing method rejects ran too high. Microhoning controls size and assures a clean hole—rejects are substantially reduced.

ELIMINATED OPERATIONS
Old processing method required two operations. In one operation, Microhoning generates size and straightness within specified tolerances.

REDUCED BALANCING TIME 70%
To preclude vibration and poor operating characteristics, it is essential that shaft hole be concentric with O.D. of rotor. Microhoning reduced by 70% the amount of dynamic balancing correction required.

PROCESSING COSTS CUT 70%
Current figures show the cost of Microhoning shaft holes in rotors to be less than 30% of processing by old method.

Rotors (from 2¼ to 4 inches long) are all Microhoned on the same machine by changing adaptor in fixture and resetting stroke length.

Learn why Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME_____

TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____ D

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

NEW SHOP EQUIPMENT

Spark proofing kit, for use on gasoline engines in industrial trucks that are operated in areas where semi-hazardous fumes or elements are present, is factory installed and consists of totally enclosed and shielded distributor, shielded ignition coil, and cables for all high voltage ignition wires. Kit is available on full line of company's industrial trucks.

Lamson Mobilift Corp, Box 511, Syracuse 1, NY

Flush pin gages for inspection and production are available in Royal Flush line in four sizes—.1875, .2500, .3750, .5000 in. dia. Barrel dia ranges from ⅞ to 1⅛ in. and lengths from 1⅛ to 1¼ in. Combinations such as countersink gages, double-step pin gages are also available.

Foster & Allen, Inc, 628 South Ave. Garwood, NJ

Corrosion preventative, Profilm, is a silicate modified coating having appearance of paint. It is designed for use where corrosive elements such as acids, alkalies, moisture or salt are a source of coating failure. Applied by spray method, material adheres to metals, masonry, wood and most other surfaces. Available in colors and in both baking and air-dry grades.

Allied Porcenell, Inc, 851 S Market St, Waukegan, Ill

Adjustable hole gage, called Holojust, checks bore dia, as well as out-of-roundness and bell-mouth. Adjustable screws at either end of aluminum handle are set to any limits by micrometer or gage blocks; Go end is colored green, No-Go end is colored red. Complete set of 5 gages covers range from 7/16 to 2 5/16 in., and costs $39.50, complete with case.

George Scherr Co, Inc, 200 Lafayette St, New York 12, NY

Dual agitator tank attachment for Model 24 Lapmaster lapping machine permits both coarse and fine lapping. Attachment utilizes coarse abrasive in one tank and fine abrasive in the other. Where lapping tolerances are not critical, it is unnecessary to change laps and conditioning rings when switching from one tank to the other; a second lap and set of conditioning rings is required for fine lapping.

Crane Packing Co, Dept AMN, 6400 Oakton St, Morton Grove, Ill

NEW SHOP EQUIPMENT

High voltage starter, Type ZHA (2200-4800 volts) is self-contained, complete with control transformer supplying low voltage for pushbutton circuits. It is furnished in three interrupting ratings for squirrel cage, synchronous and wound-rotor motors. Starters are only 30 in. deep and may be mounted directly against wall, or in double rows, back-to-back. Bulletin 8130-F.

Electric Controller & Mfg Co, Div of Square D Co, Cleveland 28, Ohio

Carbide-tipped saw blades featuring new Penta-Cut teeth are designed for cutting non-ferrous metals. Carbide tips are of alternate design to provide a group of five cutting edges in every set of two teeth. Male tooth in set has slightly wider kerf (.007 in.) to provide planing action as saw cuts. Blades are easily sharpened, and are available in 12, 16, 18 and 20-in. dia.

Victory Carbide Saw & Tool Co, 3856 N Ashland Ave, Chicago 13, Ill

Drill folder listing Super Cobalt Drills is offered free and lists complete line of tools. Sizes are in fractional, wire gage and letter size drills including straight and taper shank models. Bonding bits are also listed.

Chicago-Latrobe, 411 W Ontario St, Chicago 10, Ill

Cushion clamps, TA1500 Series made of stainless steel, withstand temperatures up to 1500 F. Available in size range from ¼ to 3 in. ID, units are interchangeable with any standard AN, MS, or commercial cushioned loop clamps.

TA Mfg Corp, 4607 Alger St, Los Angeles 39, Calif

Single-pass Acme taps are now available in a range of sizes from ⅜ to 2½ in. They feature a built-in leadscrew thread which eliminates need for external leadscrew and permits complete Acme tapping with one tap and in one operation.

Horspool & Romine Mfg Co, Inc, 5850 Marshall St, Oakland 8, Calif

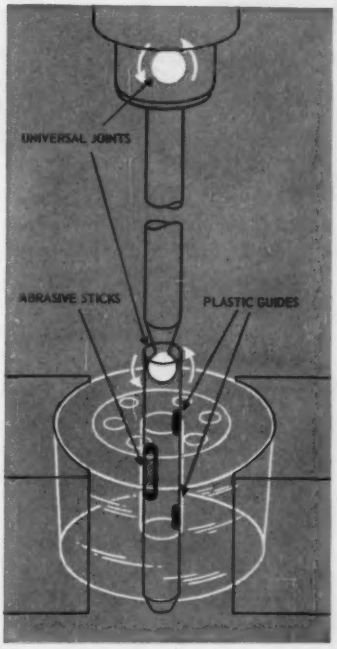
Soluble oil mixer consists of a noncorrosive brass mixing head that has an intake for water, intake for oil, mixing chamber, and dispensing outlet from which a uniform emulsion is automatically expelled.

Force-Flo, Inc, PO Box 2442, East Cleveland 12, Ohio

HOW MICROHONING Laminated Rotors Cuts Processing Costs

Emerson Electric squirrel-cage rotors are made of special "electrical grade" steel laminations and each lamination is coated with oxide insulation. In processing the rotor, the O.D. is turned concentric with the shaft hole. Then, in one operation, Microhoning accurately generates finished size and straightness of shaft hole without any change in hole location.

The Micromold tool has two universal joints in the drive shaft which allow the tool body to align itself with the shaft hole. Microhoning of holes is along same axis from which O.D. was turned.



For electrical and mechanical efficiency, assembled motors must have a uniform air-gap between rotor and stator of .006 inch to .011 inch. Because laminated surface is rough and close tolerances must be held, special guided Micromold tools are used. Plastic guides above and below abrasive sticks, control dressing of abrasive and assure generation of round, straight shaft holes.

Before installing Microhoning equipment, two operations were required to finish shaft hole—rejects ran high. Microhoning greatly reduced the amount of dynamic balancing correction required.

The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____ D

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

ONLY

GOSS and DELEEUW

AUTOMATIC CHUCKERS

offer the 1-2-3 feature

This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economically in any quantity.

The examples of work shown here are typical of the wider variety of parts being produced on these new machines.

SEND FOR detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

GOSS & DELEEUW

QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW

MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

NEW SHOP EQUIPMENT

Nylon-tubing tools, one a tube cutter and the other a flaring tool, have been developed. No. 300-FP flaring tool makes 45° flares on six sizes of nylon tubing between 3/16 and ⅝-in. OD. No. 227-FP tube cutter will cut nylon or similar tubing from ⅛ to ¾-in. OD. Cutter should not be used with metal tubing.

Imperial Brass Mfg Co, 1200 W Harrison St, Chicago 7, Ill

Indicating paint, Tempa-Dot, has been developed for application to heat treated parts that have been plated, pickled or phosphate treated, to show that part has been relieved of hydrogen embrittlement. It is red before baking and changes color after proper bake. It will reportedly detect a deviation of ± 25 F. Available in handy applicator tube.

EverLube Corp, 6940 Farmdale Ave, N Hollywood, Calif

Adjustable numbering device for permanently marking serial numbers on all metals is hand operated, uses electro-chemical etching process, and features company's power unit as power source. Device has four or more plastic numbering wheels set in the stainless-steel frame. Numerals and letters may be ¼-in. square or smaller.

Electromark Corp, 2093 E 19th St, Cleveland 15, Ohio

Six-power magnifier, designated Magnaglass, consists of a 6-power lens 1 1/16 in. in dia mounted in a transparent plastic housing. Housing contains permanent magnets which allow magnifier to be attached to any ferrous metal gage or rule for magnifying fine calibrations. Price, including case, is $3.00.

Magnaglass Mfg Co, Inc, Fredonia, NY

Coolant called Tooleze 1234 is said to possess wetting properties that provide max cooling efficiency and permit fast, heavy cuts. Water-soluble compound prevents welding of chips to cutting tool, also acts as an effective rust preventive.

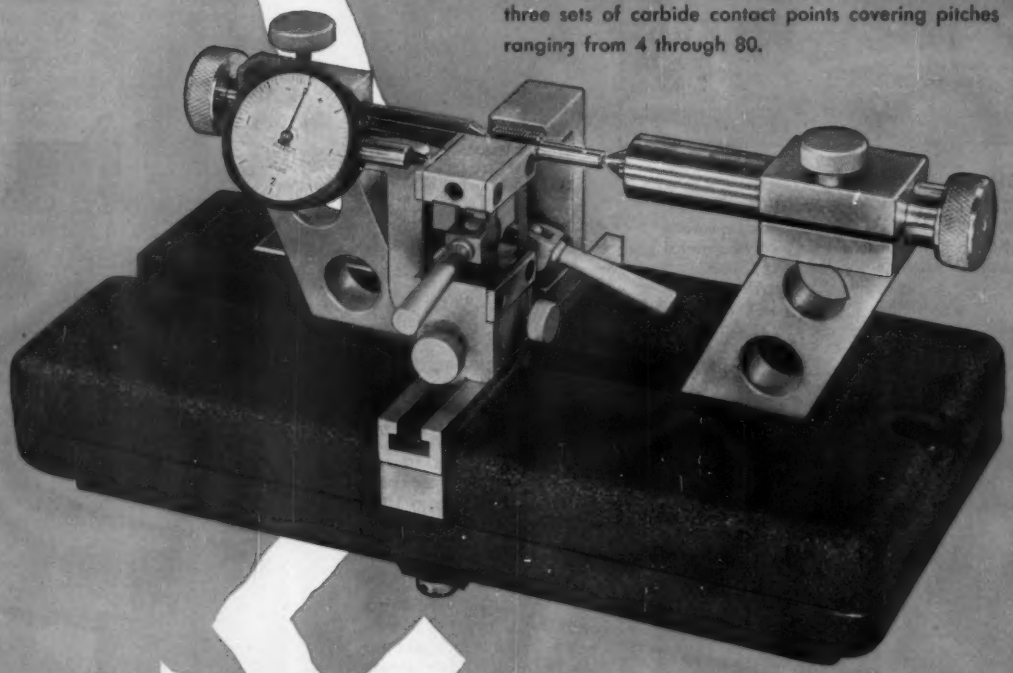
International Chemical Co, Dept 275, 2628 N Mascher St, Philadelphia 33, Penna

Vinyl-coated metal called Texkote is available in 18- through 30-gage thicknesses in aluminum or steel. An adhesive is applied to metal and heated to high temperature; after

NEW!
DRUNKEN THREAD CHECKER

Now, with the PMCo Drunken Thread Checker, it is possible to accurately check another element—"drunken threads." This new instrument, developed after many years of study, is manufactured of the finest materials, by a team of expert craftsmen. It simplifies accurate reading of helix deviation.

The PMCo Drunken Thread Checker has a capacity up to 3¼" diameter. Maximum measuring distance between centers is 5⅝". It is furnished complete with three sets of carbide contact points covering pitches ranging from 4 through 80.



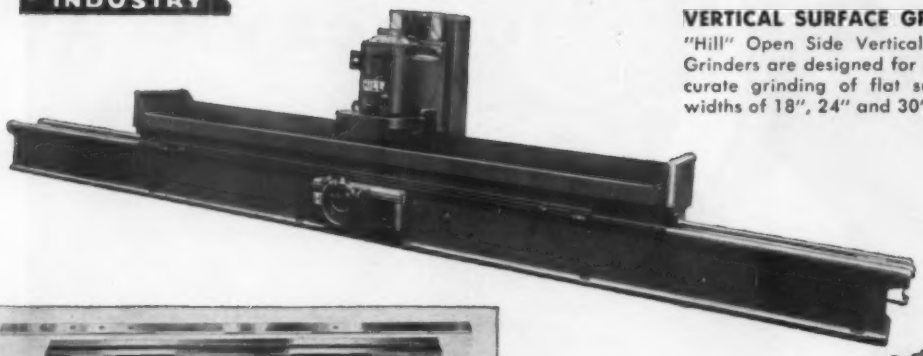
THE PIPE MACHINERY CO.
29100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

Today Get the Pipe Machinery Co. "Drunken Thread Checker" Pamphlet #1. Fill in this coupon.

Name_____
Company_____ Title_____
Address_____
City_____ Zone____ State_____

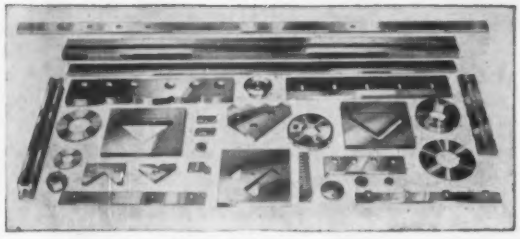
HILL ACME

HILL ACME TOOLS FOR INDUSTRY



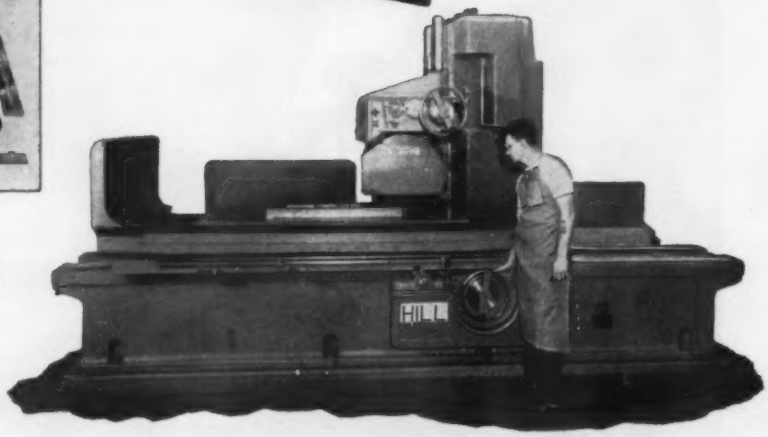
VERTICAL SURFACE GRINDERS

"Hill" Open Side Vertical Spindle Hydraulic Surface Grinders are designed for rapid stock removal and accurate grinding of flat surfaces. Furnished in table widths of 18", 24" and 30"; table lengths 60" to 240".



SHEAR KNIVES

"CLEVELAND" Knives and Shear Blades. Solid and laid steel shear blades; rotary slitting and side trimming knives; metal cutting machine knives.



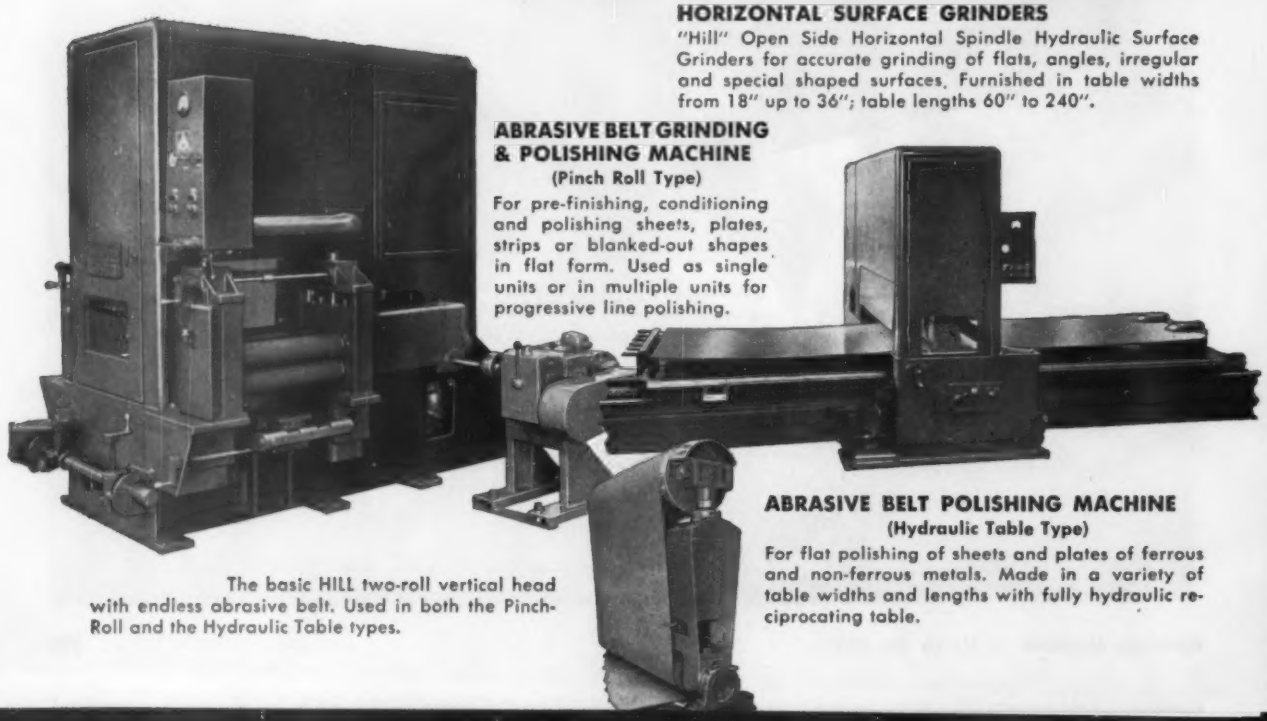
HORIZONTAL SURFACE GRINDERS

"Hill" Open Side Horizontal Spindle Hydraulic Surface Grinders for accurate grinding of flats, angles, irregular and special shaped surfaces. Furnished in table widths from 18" up to 36"; table lengths 60" to 240".

ABRASIVE BELT GRINDING & POLISHING MACHINE

(Pinch Roll Type)

For pre-finishing, conditioning and polishing sheets, plates, strips or blanked-out shapes in flat form. Used as single units or in multiple units for progressive line polishing.



The basic HILL two-roll vertical head with endless abrasive belt. Used in both the Pinch-Roll and the Hydraulic Table types.

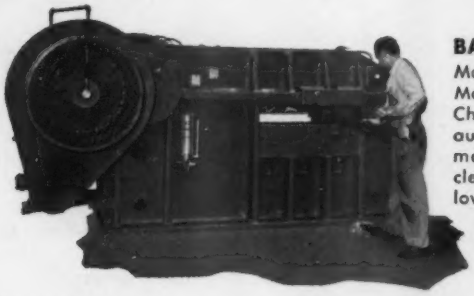
ABRASIVE BELT POLISHING MACHINE

(Hydraulic Table Type)

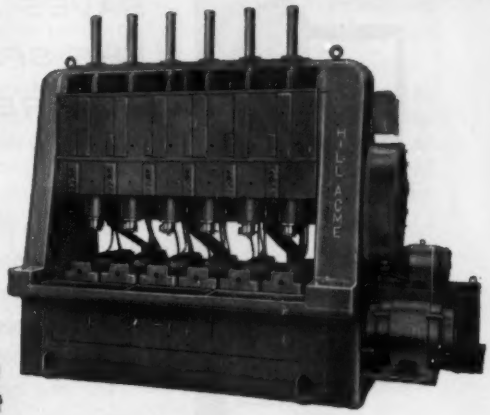
For flat polishing of sheets and plates of ferrous and non-ferrous metals. Made in a variety of table widths and lengths with fully hydraulic reciprocating table.

Tools for Industry

HILL ACME TOOLS FOR INDUSTRY



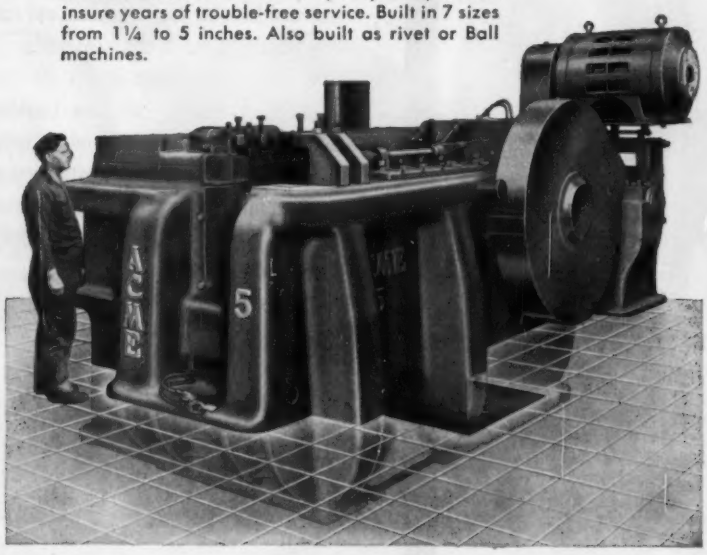
BAR-BILLET SHEARS
Modern, efficient design. Made in 3" to 6½" sizes. Choice of hand, semi-automatic or fully automatic feed. Assures clean, square cuts with low maintenance.



ALLIGATOR SHEARS
"CANTON" Alligator Shears are the most rugged, powerful and trouble free shears ever built for processing scrap. Modern design has produced a stronger shear, with fewer parts, and positive lubrication. Made in a full range of sizes to meet every condition.

TAPPING MACHINES
"ACME" model XC-W six spindle Coupling Tapper. Built in 1" capacity and larger, in 6 or 8 spindle. Can be adapted as a nut tapper.

FORGING MACHINES
"ACME" XN Forging Machines produce accurate, quality forgings for long uninterrupted periods. Massive construction and simplicity of operation insure years of trouble-free service. Built in 7 sizes from 1¼ to 5 inches. Also built as rivet or Ball machines.

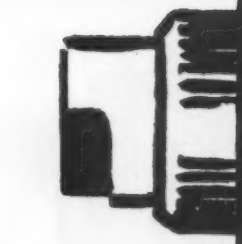


THREADING MACHINES
"ACME" HA Single and Double Spindle Threading Machines are equipped with tangent or hob type die head which assures economical, accurate, high speed production. Furnished in sizes from 1" to 2½" capacity.

THE HILL ACME COMPANY

1201 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING THREADING • TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES



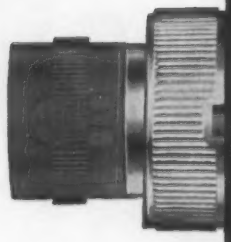
NEW PUSH-LITE* SAVES HALF THE SPACE AND REDUCES COST

Using both a pushbutton and indicating light on one operation will soon be old-fashioned. In fact, it's a waste of money and space because one new Push-Lite unit will do both jobs.

The new unique Push-Lite with its button-shaped plastic lens combines the functions of both a pushbutton and indicating light. One push transmits the appropriate signal and, at the same time, energizes the indicating lamp.

Push-Lites are liquid-tight as are other operators and lights in the Westinghouse Oil-Tite* pushbutton line. Precision-machined fits and neoprene seals will not allow liquids to reach electrical parts.

For more information about Oil-Tite pushbuttons ask for the new booklet (B-7022) or the 72-page Pushbutton Guide (B-6749), a catalog of all Westinghouse pushbuttons. Write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. or call your local Westinghouse distributor. *Trademark J-30253



YOU CAN BE SURE...IF IT'S Westinghouse

cooling, liquid vinyl is applied; material is reheated and embossed. Material is available in a variety of colors and textures, and can be deep drawn, stamped and roll-formed without damage.

Sun Steel Co, 1702 W 74th St, Chicago 36, Ill.

Solid carbide routers are designed for use on abrasive materials such as plastics, die castings, copper, fibre, wood and rubber. Full range of standard sizes is available in all series such as single straight flute, single r-h spiral, single l-h spiral, two flute straight, two flute l-h spiral and three flute l-h spiral.

Atrax Co, Newington, Conn

Epoxy hardener, Sonite No. 21, is an acid anhydride curing agent that reportedly gives epoxies improved heat distortion temperatures, physical and electrical properties. Material comes in powdered form in pint, quart and gallon containers.

Smooth-On Mfg Co, 572 Communipaw Ave, Jersey City 4, NJ

Clutch with oversize, sliding-key-type clutch dog encased by steel collar which removes driving load from crankshaft keyway is now standard equipment on 2-ton Benchmaster punch presses. This clutch is already used on company's 5- and 8-ton models.

Benchmaster Mfg Co, 1835 W Rosecrans, Gardena, Calif

Drills in Hi-Brinell line are now offered in an extended range of standard stock sizes from 1/16 to ¾ in. in diameter. Suitable for drilling hardened ferrous materials, tools up to ⅛-in. dia have a solid carbide insert brazed into a tool-steel shank. Sizes from 3/16 to ¾ in. are equipped with a carbide tip brazed into a tool-steel shank with a straight flute.

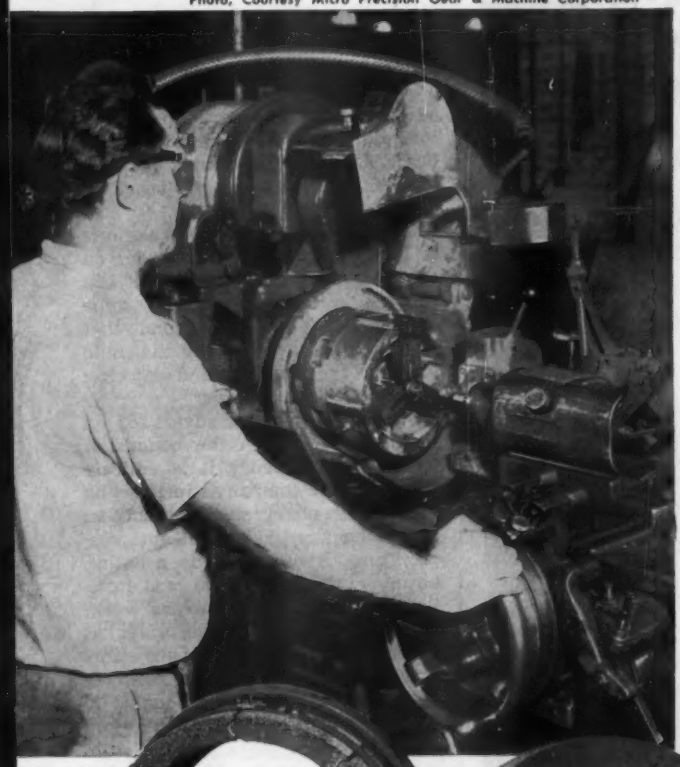
Ace Drill Corp, Adrian, Mich

Insulation coating called No-Short is resistant to all acids and unaffected by heat up to 550 F. Used primarily on electrodes, holders, and seam-welding wheels, material is a factor in reducing shorts in resistance welding and for other electrical insulation where good bonding and wearing characteristics are needed. Coating can be painted on.

Lovell Chemical Co. Watertown 72, Mass

Sterling's "sixth element" grinding wheels offer new standards of job-tailored quality

Photo, Courtesy Micro Precision Gear & Machine Corporation



SOMETHING NEW has been added to the standard grinding wheel elements—grain, size, grade, structure and bond. In making its specifications, Sterling considers a *sixth element*—the *human* element—to create an abrasive unit closely tailored to the demands of each individual job.

The sixth element concerns the operator, what he likes in a grinding wheel, what he expects it to accomplish, his work habits, his unusual preferences, and all the many other personal factors that come into being when he works at his machine.

It is this close attention to the *sixth element* that gets more production out of the wheel, sets new standards of economy, and reduces job-fatigue. Creating specifications that are slanted to the operator's likes and dislikes is a special ability that Sterling abrasive engineers will gladly apply to your grinding problem. Write us or your nearest Sterling distributor.

Sterling's small internal grinding wheels carry with them the same assurance of economical performance and quality as the largest "Wheel of Industry." Use them with confidence in superior results.

STERLING GRINDING WHEEL CO. TIFFIN OHIO
USE SAFETY GUARD - SEE A.S.A. SAFETY CODE
STERLING GRINDING WHEEL CO.
USE SAFETY GUARD - SEE A.S.A. SAFETY CODE
STERLING GRINDING WHEEL CO.
TIFFIN, OHIO

"Wheels of Industry"—Vitrified and Resinoid—provide the most economical and efficient method of metal removal.

STERLING GRINDING WHEELS

"THE WHEELS OF INDUSTRY" STERLING

STERLING GRINDING WHEEL CO., TIFFIN, OHIO—SUBSIDIARY OF ABRASIVE AND METAL PRODUCTS COMPANY

There's a Ruthman GUSHER Coolant Pump to fit every requirement

IMMERSED TYPE

Available in 1/10 to 5 HP in either long or short models with separate tank units if desired.

Model 6-P3

PIPE CONNECTED TYPE

Available in ¼ to 5 HP. Easy to install—provides long trouble-free operation.

Model Y-LO

FLANGE MOUNTED (External Discharge)

Available in 1/10 to 5 HP, long or short models. Simple, sturdy design with fewer parts to wear.

Model 11022

FLANGE MOUNTED (Internal Discharge)

Available in 1/10 to 5 HP long or short models. Can be easily and quickly installed in most convenient place.

Model 11027

SHAFT & PULLEY DRIVEN

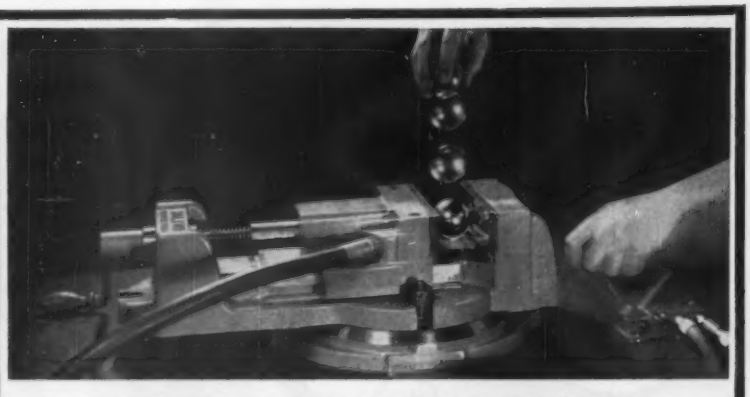
Gusher Coolant Pumps are also available for installation with shaft coupling or pulley drive, these pumps are supplied without electric motors.

THE RUTHMAN MACHINERY CO.

Write For Catalog

1818 Reading Road

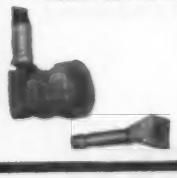
Cincinnati, Ohio



FASTER MACHINE LOADING?
MILOMATIC IS ON THE BALL!

In the time it takes a 1" steel ball to drop 6 inches, MilOmatic air powered hydraulic vises close automatically! This split second automatic clamping action is the perfect way to cut costs and increase production on high speed operations, in which efficiency depends on fast loading and unloading. You can use MilOmatics on any machine in your plant, as an automatic production fixture, and you can adapt them to any work piece with low cost jaw inserts. Get on the ball! Get the facts about MilOmatic today!

Attach this ad to your letterhead for free demonstration or new free catalog!



WILTON TOOL MFG. CO., INC.

SCHILLER PARK, ILLINOIS

Sold By Leading Distributors The World Over

ROUND TABLE Discussion

TROUBLE BOARD

What's the best way to give the breeze to a complaining worker who's been stung buying something listed for sale on the department bulletin board? Should the company supervise notices put up on the board?

The practice of permitting workers to communicate with each other on the "for sale or exchange board" is a courtesy graciously granted by some employers. It is also found that many super-markets have the same idea for the courtesy and convenience of their customers.

So long as what is advertised on the board is within the bounds of legality and decency it is entirely outside of the company's jurisdiction —assuming, of course, that it isn't an excuse for a worker to kill unnecessary time. I would put up a notice, however, that the board was instituted as a convenience to the workers and that its abuse, such as spending too much company time thereby, would result in its removal.

Now let's confine our thoughts to the sucker who was baited and hooked into buying a no-good automobile. Why Al should allow himself to be upset by an individual who from all appearances seems to be a poor sport, I cannot understand. Anybody who is foolish enough to pay for a car without first ascertaining its true condition deserves to get what is coming to him. I have a great aversion to a poor sport and in particular anyone who enters into a bargain and then proceeds to

"It's just for carrying my lunch . . . the wife thinks it makes me look like a businessman."

How much profit is machined out of your product?

Whenever your product is finished one micro-inch more than specified, profit is actually machined away. In the past, this waste was due to the machinist's inability to accurately judge how far he had progressed in his surface finishing operations.

This situation need not exist today. Brush has developed a remarkable new tool, the Brush SURFINDICATOR*, that can be used by anyone to accurately measure surface finish on metal, paper, wood, plastic—*any* material.

The Brush SURFINIDCATOR provides a fast, precision means for checking surface finish right at the machine. Fully portable . . . no special training required.

Here's how profit can be protected

The SURFINDICATOR measures surface finish to within one micro-inch providing a direct reading in accordance with new industrial and military standards. A hand-held stylus is simply stroked over the surface to be measured and the reading taken—no special training is required. The entire SURFINDICATOR is completely portable and permits the machine operator to finish a surface to exact specifications—no more, no less—no wasted machine time, no rejects.

And, to permit accurate re-calibration in the field, precision reference specimens are supplied with every instrument. These specimens, exclusive with Brush, are the ASA approved precision reference standards for surface finish measurement.

SURFINDICATOR booklet contains new ASA standards and complete details on cost-saving finish measurement . . New Surface Finish Control Efficiency Study can be made on your production line.

The complete story on how the SURFINDICATOR prevents overfinishing, protects your profits, can be obtained on request. A Surface Finish Control Efficiency Study form is also available to aid in evaluating finishing cost efficiency in your plant. Write for both the SURFINDICATOR booklet and the Efficiency Study form today. *T. M.

BRUSH ELECTRONICS COMPANY

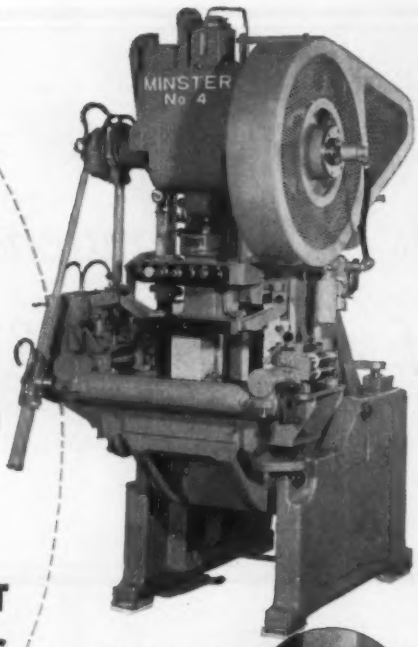
3505 Perkins Avenue, Cleveland 14, Ohio

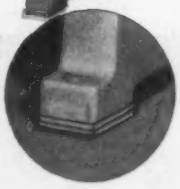
BRUSH 6 ELECTRONICS

DIVISION OF CLEVITE CORPORATION

THIS MINSTER No. 4 PRESS IS INSTALLED ON VINYL Air-Loc AIR-LOC

THE MOUNT THAT HOLDS





This impact machine installed on 8 mounts 4½" x 4½" to provide double thickness under each foot.

Air-Loc AIR-LOC 4·17·4 THE VINYL MOUNT that dampens vibration, gives you these advantages . . .

1. VINYL CONSTRUCTION is impervious to oil, water, alkali and weak acids. 2. EASY TO CUT with a power saw. 3. PERMANENT MACHINE ALIGNMENT. 4. PRECISION SHIMMING is easy. 5. REUSABLE when relocating machines. 6. NO "WALKING", anchored by friction without bolts or cement. 7. REDUCES VIBRATION up to 85% due to patented construction.

Return coupon today to prove this in your own plant.

Free Booklet and Samples. Return Coupon Today.

Precision grinders, lathes, planers, etc. installed on AIR-LOC *maintain level* and operate at peak efficiency because transmitted vibration is reduced as much as 85%.

AIR-LOC DIVISION
Clark, Cutler, McDermott Co., Franklin, Mass.

NAME _____
(Please print)
TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE ____ STATE ____

whine when he sees that he got the short end.

So far as the annoying insect, who persistently becomes a pain in the neck to Al with his complaints of being gypped is concerned, I would join with Ed in recommending that he be subjected to a few whiffs of DDT in the form of a good kick in the seat of his trousers and sent down to Personnel.

What I wonder is why in heaven's name a foreman—one who is supposed to possess the qualifications of a good executive—should be so indecisive as to solicit another's views on what he should do to combat the thing which gets him on edge. It may be that this particular pest saw Al push someone off a high bridge and the foreman desires to keep in the man's good graces. How true to the nature of a Hank to be expecting the company to look out for his interest after he has gotten himself in a hole. Hank, the spineless jellyfish, is one of a legion who looks to his employer to save his neck after he himself has put the noose around it.

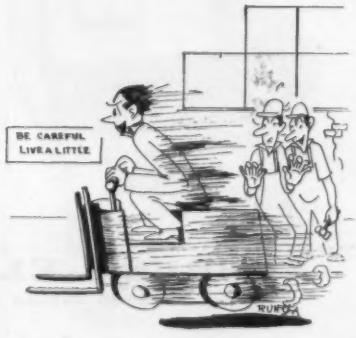
The more a foreman tolerates these complaining individuals the greater will be the annoyances darting in his direction. Don't keep taking it on the chin, Al, or you won't retain that industrial know-how — effectiveness in dealing with others.

John Homewood
Laguna Beach, Calif

An employee listed his car for sale on the shop bulletin board. Another employee bought the car and found it was a lemon. He is griped, and gives the foreman a hard time.

In every shop we find an employee who holds the foreman personally responsible for everything that hap-

(Continued on page 240)



"Now there's a guy that's going to be grounded before the day's over . . . !"

add Bearings, Inc. engineering service to a good idea . . . get a better product!

A prominent manufacturer of electrical motors uses 110 of these flyer assembly spindles to wrap insulating wire. They worked fine — much better than old type spindles but the life of the bearings averaged only one to two weeks per unit. This caused serious delays in production and an excessive bearing replacement cost.

Bearings, Inc. engineers were given the problem. All spindles were shipped to our complete Spindle Repair Department in Cleveland. The housings and shafts were reworked to accommodate a machine tool precision bearing with proper clearances and preloads to meet the most rigorous service demands.

Within a short time these spindles were back in service, operating at higher speeds than had been possible before. They wind evenly with uniform tension, wire breakage is eliminated and the bearings are giving exceptional service life.

Do you have a bearing problem? Want replacement bearings in a hurry? Ask our branch nearest you for *any* service involving bearings — they're ready NOW to help you!

Rendering bearing service in the territories adjacent to our branches, listed below.

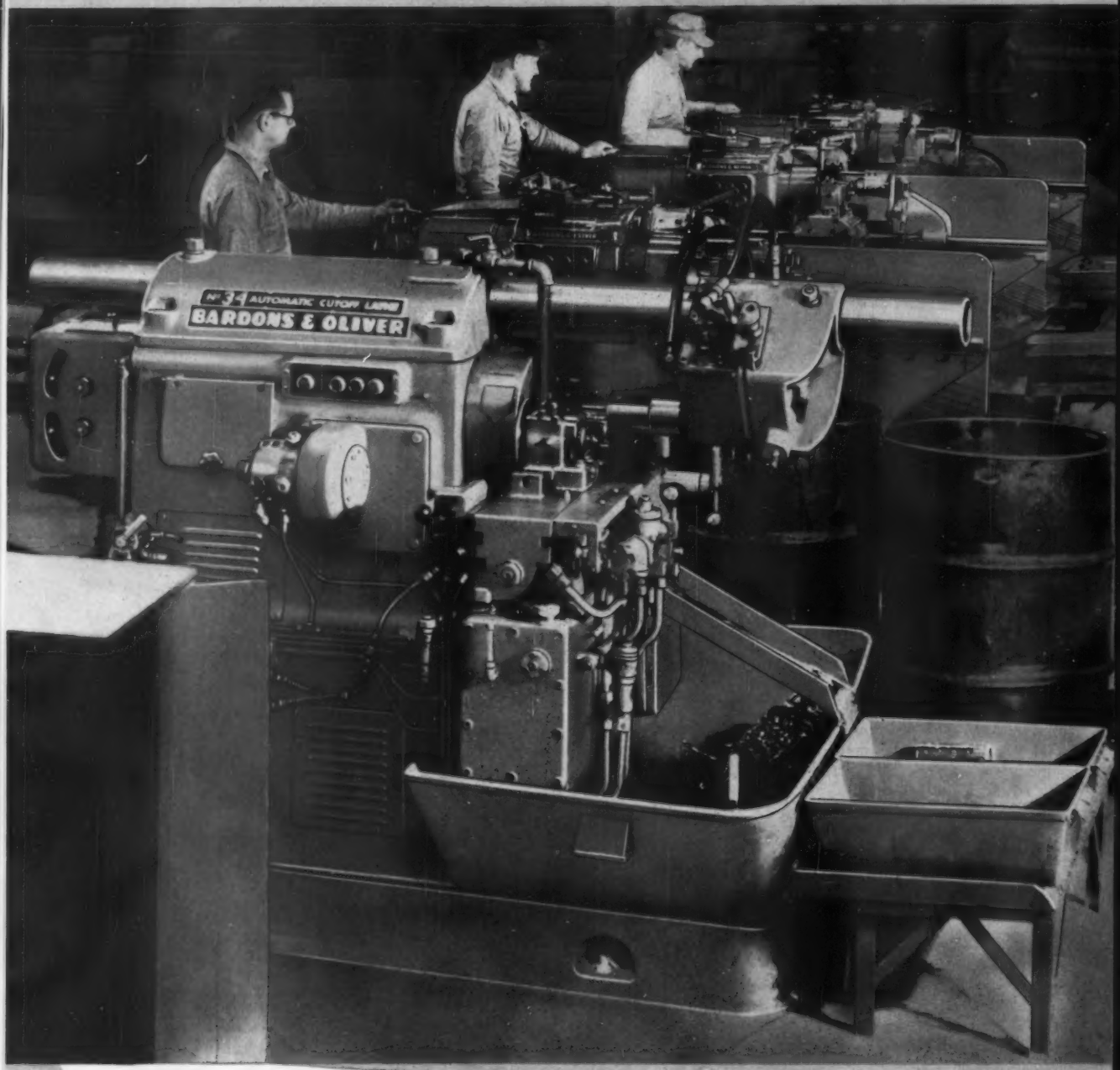
BEARINGS, INC.

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Mansfield • Toledo • Youngstown • Zanesville
INDIANA: Ft. Wayne • Indianapolis • Muncie • Terre Haute
PENNSYLVANIA: Erie • Johnstown • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Wheeling
NEW JERSEY: Camden • **MARYLAND:** Baltimore
DELAWARE: Wilmington •
Subsidiaries: Balanrol Corp. • Buffalo, N.Y.• Kentucky Ball and Roller Bearing Co. • Louisville, Ky.

Standardizes on

GRINNELL CORPORATION

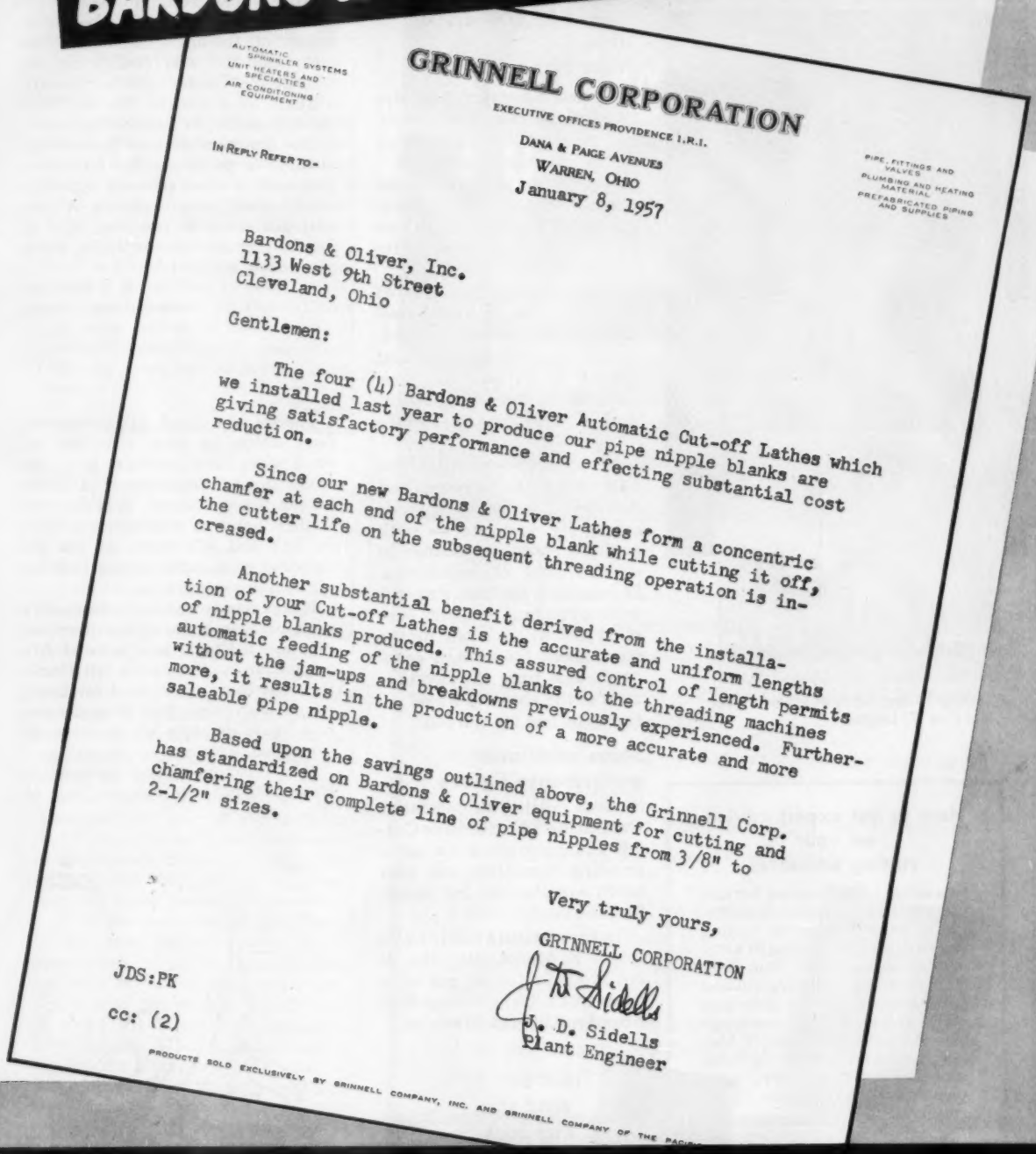
IN ITS MANUFACTURE OF PIPE NIPPLES



Bardons & Oliver Cutting-Off Lathes are available in eight sizes ranging from 2″ dia. capacity to 16″, and are built as Automatic, Semi-Automatic or Hand Operated.

Standardizes on

BARDONS & OLIVER Cutting-Off Lathes



AUTOMATIC SPRINKLER SYSTEMS
UNIT HEATERS AND SPECIALTIES
AIR CONDITIONING EQUIPMENT

GRINNELL CORPORATION

EXECUTIVE OFFICES PROVIDENCE 1, R.I.
DANA & PAIGE AVENUES
WARREN, OHIO

PIPE, FITTINGS AND VALVES
PLUMBING AND HEATING MATERIAL
PREFABRICATED PIPING AND SUPPLIES

IN REPLY REFER TO-

January 8, 1957

Bardons & Oliver, Inc.
1133 West 9th Street
Cleveland, Ohio

Gentlemen:

The four (4) Bardons & Oliver Automatic Cut-off Lathes which we installed last year to produce our pipe nipple blanks are giving satisfactory performance and effecting substantial cost reduction.

Since our new Bardons & Oliver Lathes form a concentric chamfer at each end of the nipple blank while cutting it off, the cutter life on the subsequent threading operation is increased.

Another substantial benefit derived from the installation of your Cut-off Lathes is the accurate and uniform lengths of nipple blanks produced. This assured control of length permits automatic feeding of the nipple blanks to the threading machines without the jam-ups and breakdowns previously experienced. Furthermore, it results in the production of a more accurate and more saleable pipe nipple.

Based upon the savings outlined above, the Grinnell Corp. has standardized on Bardons & Oliver equipment for cutting and chamfering their complete line of pipe nipples from 3/8" to 2-1/2" sizes.

Very truly yours,

GRINNELL CORPORATION

J. D. Sidells
Plant Engineer

JDS:PK

cc: (2)

PRODUCTS SOLD EXCLUSIVELY BY GRINNELL COMPANY, INC. AND GRINNELL COMPANY OF THE PACIFIC

BARDONS & OLIVER, INC.

1134 WEST 9TH STREET • CLEVELAND 13, OHIO

MANUFACTURERS OF A COMPLETE LINE OF TURRET LATHES AND CUTTING-OFF LATHES

Abrasive Cutting | *the best way to cut many materials the only way to cut some*

Campbell Cut-Off Machines

• Cutting 20-foot tubes of stainless steel into 1" to 17" lengths

•

Slice $32,000 a year from tube cutting costs

• Because CAMPBELL Abrasive Cut-Off Machines not only cut stainless steel tubes twice as fast as former methods—but the clean cut saves a deburring process—Ryan Aeronautical Company saved $32,000 the first year of its operation.

Ryan uses thousands of pieces of this stainless steel tubing each month in ball-and-socket joints, nipples and sleeves of exhaust systems. They must be precision-cut from 20-foot pipe in lengths from 1 to 17 inches.

The smooth-finish cut of the CAMPBELL Oscillating Wet Abrasive Cut-Off Machine is extremely accurate — with no hard spots, no change in metallurgical characteristics. It results from the WET cut with abundant coolant supplied just where it will do the most good. Speed and economy come from the OSCILLATION of the abrasive wheel . . . the right one for the job.

Some additional performance figures

Smooth cutting on CAMPBELL Oscillating Wet Abrasive Cut-Off Machine saves an extra grinding operation on gear tooth samples cut for metallurgical study.

International Nickel's tough K Monel, 4¼" dia., is cut in 2 minutes per cut on a CAMPBELL Oscillating Wet Abrasive Cut-Off Machine.

How to get expert advice on your cutting problems

• CAMPBELL Engineering Service costs you nothing—can save you much. Does your metal cutting problem involve cutting of alloy or high carbon steel? Our Field Engineers are abrasive cutting specialists. They can help you arrive at just the right combination of a CAMPBELL Cut-Off Machine and ALLISON Cutting Wheel that will improve your operation and save you money.

Let us send you this book

ACCO

TRADE MARK

Campbell Machine Division
AMERICAN CHAIN & CABLE

923 Connecticut Avenue, Bridgeport 2, Connecticut

pens in the shop. The foreman gets fed up with the constant complaining of this worker, and considers laying him off.

There is, however, a very simple method of getting this man off his neck. Tell him that if you were in his place you would probably feel the same way. That is the best way to cool off the angry employee, stop all arguments, and change his attitude. We cannot win a friendly attitude by argument. We may win the argument, but lose the employee.

The argumentative or threatening attitude is no longer the foreman's best card. A more friendly approach would solve many problems. A general discussion of mistakes, free of anger, will let the employee know you mean business.

A E Salmons
Norristown, Penna

I wonder who hired Al's young fellows whom he must hold by the hand when directing them to do the work in his department? I think he can blame himself, because even if they have an employment office in Ed's and Al's shop, Al has the deciding word when hiring help for his own department.

Hanks has no reason to be on Al's neck because he bought a used car that was a lemon. It is none of Al's responsibility. He should tell Hanks this, but there is no need for being rough with him. The company has nothing to do with his purchase of a no-good, used car.

Ed's recommendation to step on Hanks, or put him out the door on

". . . so then Coulter said, 'If you don't give me another ten thousandths on that FO-42 bushing, I'll shove it down your throat!' "

the end of Al's toe seems to me to be at least 50 years out of date. Although I realize that a recommendation of that kind should not be taken too seriously, even the figurative conception reveals an attitude that should not be present in our days. It reminds me of earlier periods when any employer could beat his guys if they did not behave, or work fast enough. It is the mentality of the slave driver in Uncle Tom's cabin.

On this point I think neither Ed nor Al knows the spirit of our time, which is cooperation, not fighting. There are reasons to warn both of them not to go to extremes in handling their men. Their attitude is the most nourishing material for socialistic thinking. If by chance they succeed in kicking anybody out of their shop it won't be longer before the labor unions at their place of work will investigate the reason and stop any inhuman or bestial treatment.

A E Fristedt
Stockholm-Bromma, Sweden

When employees are permitted to put up personal notices about things they want to buy and sell on the department bulletin boards, there is always the possibility that the bulletin boards may become "trouble boards" to the company. This situation can be avoided if management makes it clear that it assumes no responsibility for any personal notices posted by employees.

Some industrial plants have discontinued the use of the bulletin board for any employee announcements because of the later difficulties arising over the sale of personal property listed on the board.

As to the case in point, the notice on the plant bulletin board would give every indication that the used car was in tip-top shape. An employee who has complete confidence in the plant buys the automobile. Then, when it turns out to be a lemon, the employee feels that it was recommended by the plant, and therefore the plant had some responsibility. This results in squabbles, recrimination, and antagonism that does production and employee-relations little good.

To overcome this difficulty on buying and selling personal property, many plants have posted notices on the bulletin board that they assume no responsibility for

What is your swaging I.Q.?

Are you aware of the new techniques and equipment that are making rotary swaging increasingly important as a basic precision production process? Test your knowledge of modern rotary swaging with this TRUE or FALSE quiz.

SWAGING is economical—no chips, no scrap . . .
SWAGING produces work accurate within ± .001" . . .
SWAGING improves physical characteristics . . .
SWAGING can produce inside contours . . .
SWAGING can be automatic or semi-automatic and does not require skilled labor for operation . . .
FENN is one of the largest manufacturers of a complete size range of swaging equipment . . .
FENN swaging equipment swages tubing up to 6¼" diameter and solid bar stock from pinpoint to 3¾" diameter . . .

If you answered TRUE to all the questions, your knowledge is excellent. If not, you should have more information on modern rotary swaging.

In either case, it will pay you to get a copy of the new Fenn Swaging Catalog No. SM56. Write today!

FENN ROTARY *Swaging Machines*

THE FENN MANUFACTURING COMPANY, 102 FENN ROAD, NEWINGTON, CONN.

WELLS HORIZONTAL METAL CUTTING BAND SAWS

The simple design and rugged construction of every "Wellsaw" didn't just happen. We planned it that way! Over 30 years of specialized band saw experience and know-how is your assurance of the quality and service with each machine produced by Wells Manufacturing Corporation.

There is a Wells Saw of the right style, capacity and speed to do a better, more economical job for you. Wells Saws will deliver long, dependable service. Operating and maintenance costs are very low.

Your Wells Distributor will help you analyze your requirements and select the proper model Wells Saw for your jobs.

TWO WIDELY USED WELLS SAWS

	MODEL 600	NO. 8
Capacity, Rectangular	6" x 13"	8" x 16"
Capacity, Rounds	6¾"	8"
Speeds: Ft. Per Minute	50, 90, 160, 250	50, 100, 175, 275
Motor Size	1/3 H.P.	½ H.P.
Blade Size	⅝" x 8'2½"	¾" x 11'6"
Height to top of Bed	25½"	25½"
Width of Bed	8½"	10¼"
Floor Space	21" x 50"	24" x 72"
Shipping Wt. (approx.)	425 lbs.	650 lbs.

Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION

505 Roosevelt Road, Three Rivers, Michigan

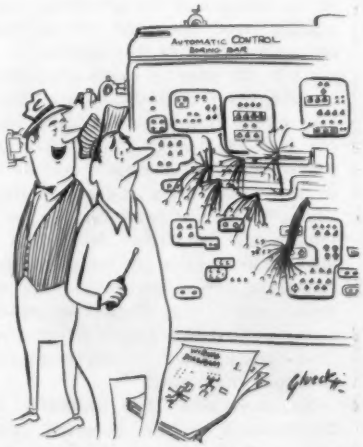
See us in booth No. 559 Western Metal Exposition Los Angeles, March 25-29

any notice posted. This notice is either included as part of the official postings, as part of the permanent bulletin board, or posted in large enough type to be easily visible to anyone reading the board.

When an industrial plant endeavors to maintain a uniform appearance on its bulletin board, there is a tendency to use specially prepared announcements. These may have the plant name on them to eliminate the possibility of unauthorized notices being posted for a short period of time. I would suggest that if such practice is followed that the notice avoid including the name of the plant. A distinctive border or type of paper will still provide posting control and will not infer any company recommendation of the advertised personal property.

In the case under discussion, the foreman should not let himself get irritated by the worker who got stung and expects the company to make it up to him. The foreman should make it crystal clear to the worker that the company does look out for his interests where they have to do with employer-employee work matters, but that personal ads for used cars and appliances are not company responsibility.

It is an unfortunate situation, but there's always some hare-brained individual in every department who gets stuck with a personal difficulty and wants his foreman to bail him out. A good dressing down by the foreman, pointing out the facts of the matter, and emphasizing the limits of company responsibility for personal difficulties should put the quietus on the cry-baby. If he fails



"Think you'll have 'em connected by noon? I'd like to run a test before I leave for the ball game today—"

to see the light, and persists in bothering the foreman excessively, then it's a case for the personnel department, and necessary disciplinary action.

Harry Kaufman
Philadelphia, Penna

The trend today seems to be that all workers, when convenient, like to use the company for a shield. Somehow it appears to them that their employer is made of the "green stuff" and has nothing to worry about except how to spend the money "they make off the poor old worker."

This thinking has been a long process of education on the part of the unions and as the generations go along with our ever-increasing wage structure this trend gets more imbedded into our thinking.

Of course we all know that there is a happy medium and that labor does need to share in the prosperity but when it becomes a means to an end and the result is the lowering of our dollar purchasing power what are we gaining?

Surely when a man makes $2 an hour and has to pay $1 extra for taxes, food, and housing he is little better off than years before when $2 equalled $2. Granted it *sounds* better, and makes our way of life appear better, but is it?

This all brings us to the question of whether the company should look out for its employees in shady deals. A company does open itself to criticism when any idea such as a personal-notice bulletin board is put up. This is very true when it really okays the placing on that bulletin of "for sale" items. Uness the policy is very sharply defined and a notice of that policy also posted on the board, then the company tends to condone each and every notice that appears. So if a for-sale item is not as it is represented the company is somewhat responsible for the action.

It is quite doubtful if any company desires to become an agent in handling used merchandise and the re-sale of property, but by permitting a bulletin board, on company property, to advertise the employee's personal effects, it places a seal of approval on all such dealings.

In this case Hanks probably felt that the item offered for sale was a legitimate item of a car and that it would be as represented. It turned out to be different. Hanks may have a case if the advertisement on the bulletin stated anything about the

One of thousands of cost cutting die ribbons — saving industry millions!

"Production Proved" B. Jahn Dies have eliminated costly, unnecessary production operations for many of the world's largest manufacturers.

At the conception of a new product . . . at the design stage . . . explore the possibilities of creating a better product at less cost with the ingenuity and automation built into all B. Jahn Progressive Dies. Perform 12 or more operations with each press stroke on intricate components.

Save time, cut costs! B. Jahn can design, build, production prove, and will run 50,000 components for production line use before shipping your new, time saving, cost cutting B. Jahn Die!

SEND TODAY for new, fact-packed brochure — showing dozens of cost-cutting case histories.

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CUT DOWNTIME
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Perma-braze *
CARBIDE TOOLS

*PIONEERED AND DEVELOPED BY WHITMAN & BARNES

Perma-Braze is an advanced process that enables carbide tips to be brazed with a specially developed high temperature alloy at the same time the high speed steel bodies are hardened. The results? . . . uniform body hardness and carbide tips that will not come loose due to braze melting. You can even drill cast iron dry without fear of tip failure. And the payoff? . . . less machine down-time, lower cost per hole, longer tool life. Ask your W&B distributor for Perma-Braze carbide tools today!

CALL YOUR W&B DISTRIBUTOR FOR . . .

RELIABLE ENGINEERING SERVICE

COMPLETE IN-STOCK SELECTION

PROMPT DELIVERY

"Makers of Fine Tools Since 1835"

WHITMAN & BARNES DRILLS and REAMERS

40035 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN
NEW YORK • CHICAGO • LOS ANGELES

condition, and if the employee selling the car passed it off as A-1.

Naturally we all like to think that we can do a better job of out-guessing the other fellow than someone else can, but when we do get burned we always come back crying and want amends made. Hanks is probably one of those persons who, after getting burned and finding out that no one will sympathize with him, wants to push the case. He probably likes the glory of being out in front and getting the publicity.

A foreman's job is to stop this type of action for it reflects on the department management. Perhaps you have to actually make your worker mad enough and then maybe he will go to the union with a grievance but it will serve to do one thing, it will straighten the situation out and the company will be forced to state its position on the matter and the foreman will know what that position is for further cases.

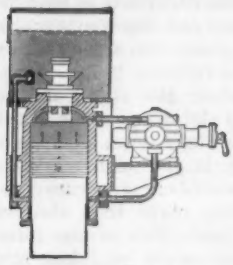
Charles D Townsend
West Hartford, Conn

The fact that a publication prints an item does not necessarily mean that the people who market the reading material are responsible for the validity of another's statement. For this reason we have editorials. They are distinguished from the other articles because it is very clear that they are policies that the paper will back to the hilt.

The inference here is that they prefer to remain taciturn on the

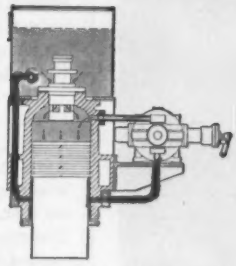
"They had the right idea when they put you in a cage."

HERE'S WHY H-P-Ms PAY OFF



Fastraverse Ram Advance

Is controlled by rate pump; withdraws oil from supporting area. FASTRAVERSE prefill system augments oil to main cylinder from overhead reservoir during advance stroke.



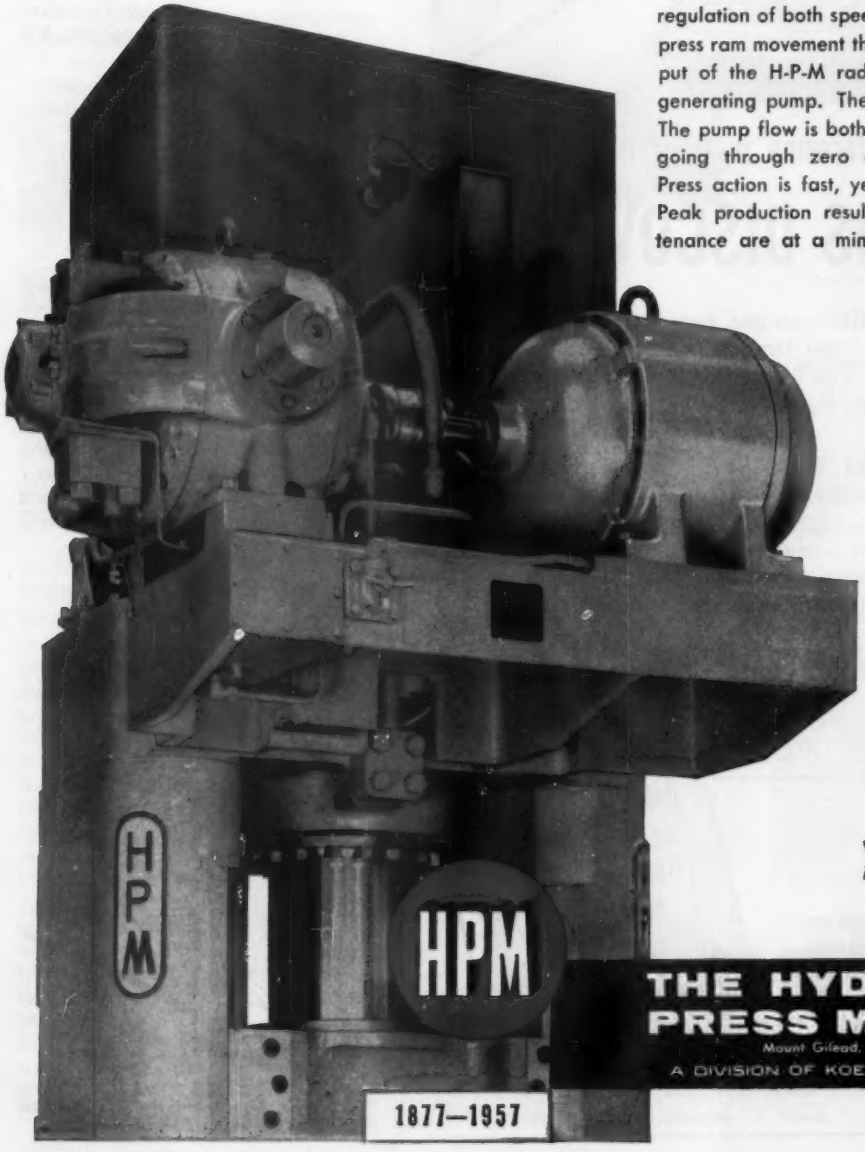
Fastraverse Ram Return

At reversal, pump delivers oil to supporting area by reversing direction of oil flow through pump. At this time, FASTRAVERSE prefill system opens and allows excess oil not handled by pump to be discharged back to tank.

FASTRAVERSE CLOSED CIRCUIT PRESS SYSTEM

Automatic Speed and Cycle Control

The H-P-M "Closed Circuit" system provides regulation of both speed and direction of every press ram movement through control of the output of the H-P-M radial piston type pressure generating pump. There is no reversing valve. The pump flow is both variable and reversible, going through zero at each press reversal. Press action is fast, yet smooth and shockless. Peak production results; idle time and maintenance are at a minimum.



Thousands of H-P-M FASTRAVERSE presses are in service today. Their dependability through performance is your assurance of satisfaction.

Write for complete information Bulletin 5500

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

There's a BIG difference in floor absorbents

MAKE THIS DISCOVERY!

RIGHT IN YOUR OWN OFFICE you can test the difference of Eagle-Picher Industrial Floor-Dry with whatever oil absorbent you're now using. You'll discover it actually absorbs as much as 100% or more liquid per pound than other floor drying materials.

YOU'LL ALSO PROVE that Eagle-Picher Floor-Dry retains its skid-proof granular mineral form even when saturated. It doesn't mud or pack. Light in weight, it spreads easier and covers a larger area. Non-combustible, it has no chemical reaction. And possessing unusual reflective power, Floor-Dry makes working conditions bright and pleasant, as well as safe!

Since 1843 EAGLE EP PICHER

WRITE TODAY. Our Eagle-Picher representative will bring the portable laboratory to your office where you may make this test yourself. The Eagle-Picher Company, Cincinnati 1, Ohio.

quotations of others. If they assumed liability the paper would have to be investigated and this would probably be more than the asking price of the article for sale.

If a fellow gets stung and holds this up to the company he is acting immature. Many times a person buys something in the open market and when dissatisfaction occurs he has no recourse other than the Small Claims Court. This is one form of action that might be taken in this instance. Not only might the customer find a more satisfactory solution, but the example might tone down potential swindlers.

A reliable worker doesn't run to the boss with every little production problem, and certainly he has no right to bring his personal troubles to the shop.

Raymon Geraghty
Brooklyn, NY

VIBRATING NERVES

Is it possible for a worker to become accustomed to the noise of his own machine, yet be bothered by the sounds of a less noisy machine next to him?

The average industrial worker must be designed to withstand a rugged life, if what they have to put up with in the way of noises is any criterion. Rarely will one find an employee who takes exception to shop noises, and I venture to say that as years go on such a person will be a novelty. If noises are any indication of man's downfall then the world has been headed for hell long ago.

My first contact with the distracting effects of ear-drum annoyances was as a youngster being led to my

"You should have heard the joke the boss just told me."

first assignment, as a crane operator, in a structural fabrication shop of the American Bridge Company just west of Pittsburgh. Big pneumatic riveters, through which large girders were fed, scared the living hell out of me as I followed my foreman around the shop. The many small, hand-operated riveters made me want to ditch the guy and beat it home to mother. An 80-lb air hose broke loose from God knows what and snaked around the floor stirring up the dust and raising particular hell in general. Did I complain about the noise and its effect on my nerves? Not by a long shot. I was being initiated into industry and before the day was out I was as noisy as the rest. My foreman didn't salaam with a "Do you mind a little noise?" as they are inclined to do in these days of scarce labor; it was "Get the hell up in that cage young fellow and get the lead out."

It was delightfully rewarding to get on the outside after the plant whistle announced the end of the day. In fact the peace was so disconcerting that I didn't hear the express whistle as I crossed the tracks and came within an inch of crossing the great divide.

I think that the wheel-to-wheel barrage, of Lloyd George fame, over in France during the final stages of World War I must have been calm in comparison with the battery of Billings and Spencer drop hammers in the Packard forge plant at Detroit. I lost no time in getting through and when I had reached the outside I had an inkling of what heaven must be like. Strange, I didn't hear a word of complaint about noise as I passed through.

Industry is like a battle and the fight of competition cannot go on without a lot of noise. If anyone is so constructed as to object to this operational necessity he had better get a job shelling peas in the back of some quiet restaurant (if he can find a quiet one).

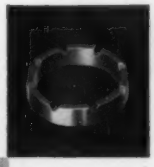
I might reveal what went on in the punch press department of the National Cash Register Company in Dayton some years back. In order to operate a shearing operation, without tearing the piece being trimmed, they had converted a large cam-operated press into a sort of an earthquake - producing outfit by notching the cam sufficiently to allow the cutting lubricant to assist the shearing. If labor's godfather had been alive at the time, Patterson would have blown his top at submitting his men to such a hell on earth. Holy-TNT-and-Hydrogen Bomb, did that machine let the

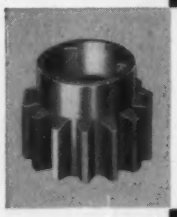
a new expanded field of

BEARING DESIGN and APPLICATION

The inauguration of Bunting's new facility for engineering and manufacturing bearings and parts of Sintered Powdered Metals opens a wide new area of opportunity to all mechanical industry.

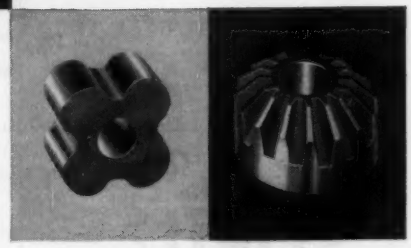
Sintered Powdered Metal Bearings and parts offer real economies in design. Bunting Engineering and manufacturing skill and traditional technical responsibility assure your most advantageous use of this material.





A competent group of Bunting Sales Engineers in the field and a soundly established Product Engineering Department put at your command, comprehensive data and facts based on wide experience in the designing and use of both Cast Bronze and Sintered Powdered Metal Bearings and parts.

● *Write for catalogs and your copy of the new 24 page Bunting Engineering handbook of Sintered Powdered products and their composition, manufacture and application.*



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BUSHINGS, BEARINGS, BARS AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL

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A Job For A TWO-HEADED MONSTER

Wm. H. Legree

PLANT SUPERINTENDENT, THE CINCINNATI GEAR CO.

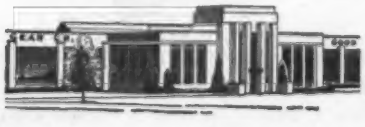
Some of the men here look on me, I'm sure, as a modern Simon Legree with a nine-foot bullwhip — which isn't really a true picture at all. In fact, I think I'm pretty easy to get along with.

But there are times when I think this job of plant superintendent calls for someone with the attributes and physical characteristics of a two-headed monster. To keep track of a couple hundred different men, working on almost as many different jobs and different machines, all involving a high degree of skill and exacting accuracy, requires something more than mere attentiveness to duty. It means I have to constantly put forth an *extra* effort to do a top-notch job.

Not that I'm trying to brag about myself; my job is tough and sometimes it seems thankless, but it has its compensations. And one of the most important of these compensations is the satisfaction of knowing that my efforts are not being wasted. Because *everyone else* here is "putting out" to do *his* part too, with the result that we have a top-notch Company turning out a top-notch product — something that our customers have come to expect from us as a matter of course.

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
Fifty Years of "Gears—Good Gears Only"

CINTI



world know that peace was out of the question! Any complaints coming from the employees in that shop? None whatever.

This delicate chap Ritter had better pack up his tools and join the Navy or take up flying. A punch press department is no place for him. It's just too bad that we have to have this annoyance in order to produce the goods, but we'll have to take the bitter with the sweet. What's the difference between the crash, crash, crash of a small punch press working alongside of your machine, Ritter, and the spluttering bla, bla, bla of an ex-governor trying his damndest to gain the seat of honor? It's a great life, Ritter, if you can take it in stride; if you can't, lawsy help you.

Harrison Mitchell
Topeka, Kan

Complaints by employees about objectionable noises in machine shops should be appreciated and investigated, because high noise levels or objectionable noises can greatly impair working efficiency. Excessive noise can indicate that machines are not running properly; ideally, all machinery should run quietly. It is significant that a machine that is overdue for overhaul is always noisier than one which is in good condition.

Noises are not all the same and their effect on the human ear is different in each case. Dripping water taps, squeaking and rattling of car bodies, the screech of a file in contact with a loosely supported piece of sheet metal are not loud noises, but they can cause intense irritation and annoyance to the hearer. It will be noted that each of the above examples of objectionable noise arises from machinery requiring maintenance or attention of some kind.

It is true that workers in noisy automatic shops become accustomed to the din, but their efficiency would be greater if the noise level could be reduced. In noisy situations, the communication of instructions becomes extremely difficult and the training of new workers is very prolonged. The labor turnover in noisy work places can be unduly high since new entrants never overcome their first dislike of the din and clatter.

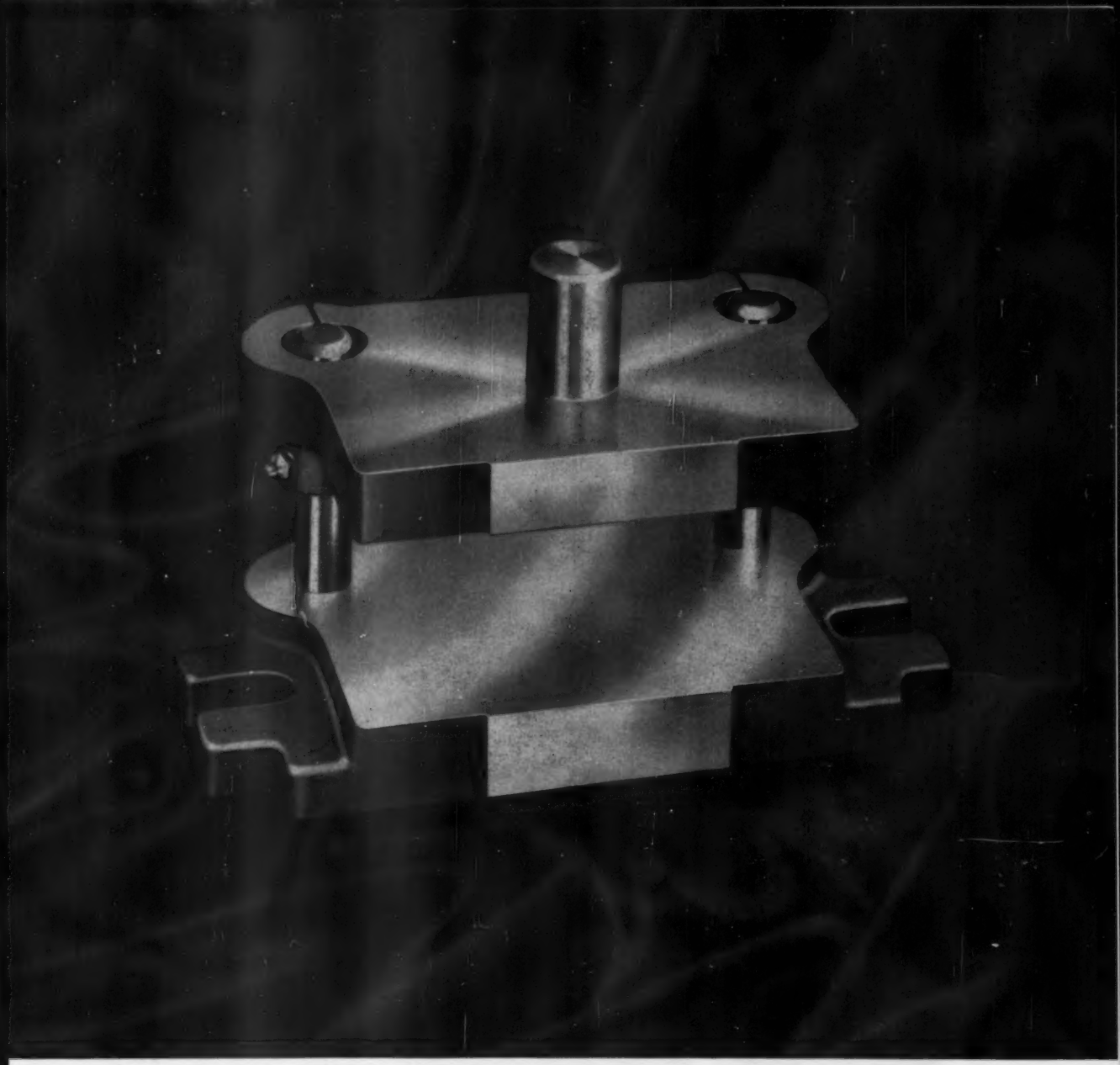
Noise can be so loud that it causes pain to the hearer and the pain level is equivalent to an intensity level of 120 decibels. Pain level is reached in thunder overhead, riveting guns, high-speed underground or subway trains and boiler-making shops.

The human ear is peculiar in the way it appreciates noise. It will detect a change in noise when the general noise level is low. If a baby cries, in a quiet room, the human ear will be sensitive to it, but if the twin brother of the baby also commences to cry, the effect on the ear will not be so marked. If you double the volume of sound, it does not have double effect on the human ear. Apart from loudness, noise frequency has a strong effect on the ear. For example, a loud noise is 70 decibels and is equivalent to a noisy street or factory at zero frequency. If the frequency of the same noise could be raised to about 3000 cycles per sec then it would be inaudible to the human ear, although a dog could probably hear it.

The limited range of the human ear in the higher range of noise frequencies has been utilized to "si-

(Continued on page 252)

"No sir, I'm not trying to infer that you're not the executive type. . . . We just don't have any openings right now."



THIS IS RIDICULOUS...

No one but a photographer ever saw a die set as shiny-bright as this one. If it's not being worked on in the tool room, usually it's buried away in a punch press, covered with oil and dirt, banging out piece after piece day after day.

And each one of those pieces is just like the others within a few thousandths of an inch. That's precision, the secret behind the success of mass production.

That's the reason for the die set's existence—to aid in maintaining precision just as long as possible. To do that, it has to be precision built.

Factory-assembled and factory-inspected, Detroit die sets meet the most important requirement of a die set, precision, in their parallelism, squareness and finish. High-quality materials plus more than ample size maintain that precision.

Over 2000 standard, stock die sets are detailed in Detroit Die Set's new catalog. Details on specials and accessories, too. Ask for it on company letterhead, or call your local representative.

OFFICES IN PRINCIPAL INDUSTRIAL CENTERS

Detroit
DIE SET
CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.

You can expand your plant,

for production men

This Avey machine drills various patterns of holes in jet engine parts by changing program drums or by alternating two automatically-driven locators which position the table accurately from a radial position. Program drum also programs one or more of the four drilling units for drilling, reaming, and similar operations.

The machine consists entirely of standard Avey units: four Aveydraulic automatic units with 12″ feed; cast iron columns; 120″ fan type steel base; 60″ Electrodex table. Top column and unit have an in-and-out traverse of 20″. The ways are mounted on steel adaptor blocks which can be removed for different heights.

All units and the index table are push button-controlled.

If you're looking for flexibility in a special machine, your Avey man's the man to see.

for management

The pressure to expand is terrific on managements who want to be prepared for the rocketing market growth predicted for the next 10 years. They realize that they will probably lose ground by standing still, but they also want to protect their balance sheets, and their peace of mind, from heavy debt due to adding costly plant space.

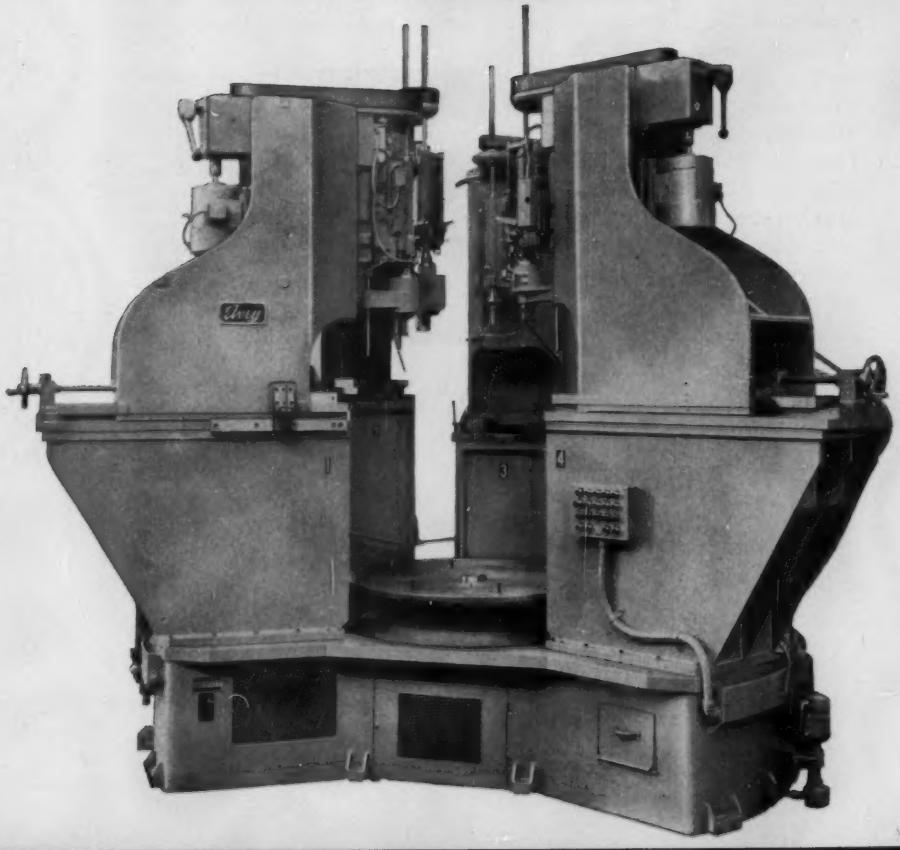
Avey production machines offer a quick and economical means of achieving the primary objective of expansion: increased productive capacity. They concentrate many operations in a comparatively small area, and free both floor space and labor for other productive operations. Their production rate enables you to increase your sales volume; and their fast pay-off rate gives you substantial earnings on your investment in a short time. Their unitized construction permits economical re-engineering to handle new parts or design changes.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

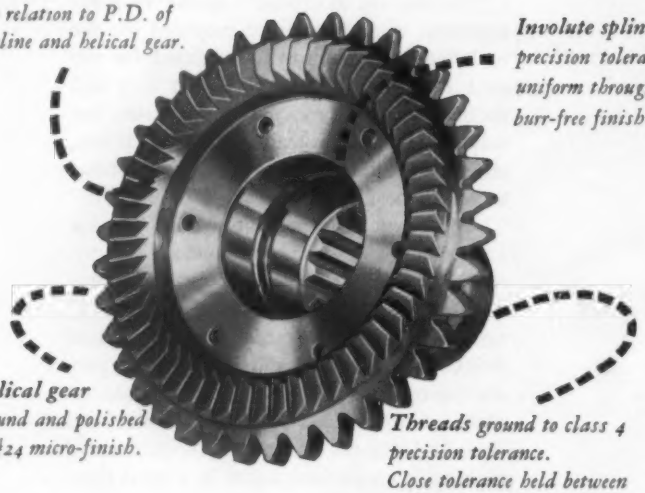
and sleep well too

Avey



Generated clutch
held at close tolerance in relation to P.D. of spline and helical gear.

Involute spline, precision tolerance, uniform throughout, burr-free finish.



Helical gear
ground and polished to #24 micro-finish.

Threads ground to class 4 precision tolerance.
Close tolerance held between thread and P.D. of helical gear.

DON'T GAMBLE WITH GEAR PERFORMANCE

YOU know that gambling with gears can cost you money — production delays, costly rejects, failures in use. You don't want to take chances with your customers . . . they expect day-in, day-out performance from your machines. Your performance guarantee can be Perkins custom-cut gears . . . precision gears made to your exact specifications. Perkins' 52 years of gear-making know-how, extensive facilities and equipment, and rigid production controls assure uniform tolerances throughout . . *.plus* a consistent micro finish. You get perfect meshing and full capacity from every gear. Many leading manufacturers — Sikorsky, Stanley, Universal Winding, for example — rely on Perkins for top-quality gears, gears that cost less in the long run. Ask us to quote on your next gear requirement. Then judge for yourself.

YOURS ON REQUEST Folder illustrating gears Perkins has made — face gears, generated and curvic clutches; bevel, spiral, helical and spur gears; ratchets, sprockets and ground thread worms — from all materials. Includes Perkins facilities for producing various gear types and sizes. *Write today.*

PERKINS
MACHINE AND GEAR CO.

Dept. 26, 101 Circuit Ave., West Springfield, Mass.
Telephone: REpublic 7-4751

lence" high speed turbine reduction gears. By shaving the tooth flanks so that the frequency was raised to more than 5000 cycles per sec, the noise was raised beyond the audible range of the human ear, but it was still present and could be measured by means of a noise meter.

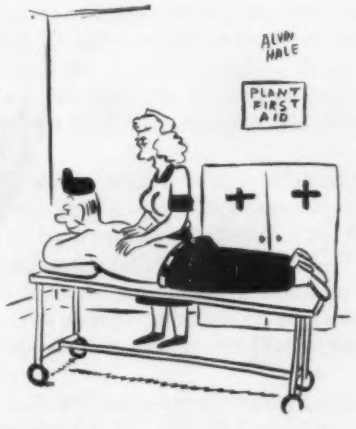
From the above, it will be apparent that the intensity of a noise and the discomfort caused by it will vary with individuals and the state of their hearing. For example, some old television sets generate a high cycle note which is almost on the threshold of human audibility. Some persons with acute hearing can be aware of it, whereas to others it is completely imperceptible.

No, noises are not all the same and neither are the people who hear them. Whenever excessive noise is caused in machine shops, steps should be taken to reduce it so far as is possible since it can have a very upsetting effect on people who have to work near it.

Clifford T Bower
London, England

Ritter's complaint that he is bothered by the noise of the nearby high-speed press is perfectly legitimate; the fact that his own machine is also very noisy is no excuse for refusing to do everything in reason to eliminate the noise as much as possible. The constant, rapid "clink, clink, clink," can be very disturbing and also cumulative; most certainly it is not conducive to smooth and efficient operation by all the nearby workers.

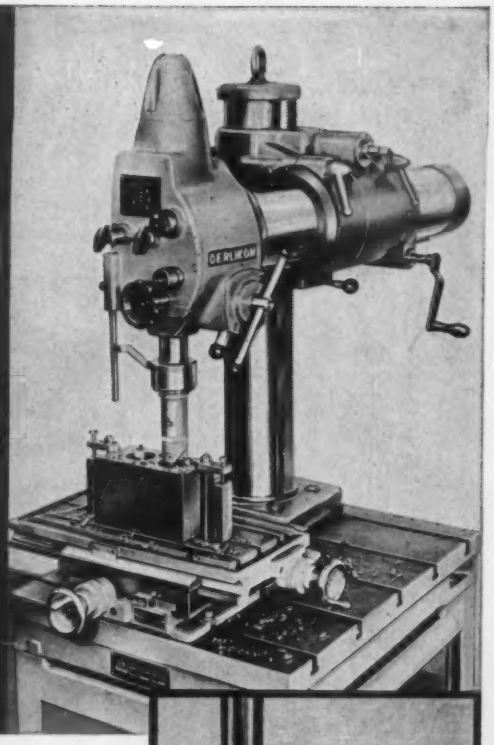
It is true that men can develop



"This makes the eighth time you hurt your back since I came here."

IN ELECTRICWARE, TOO,
Sharonsteel Quality STANDS OUT
• There are so many advantages to stainless electricware it's no surprise that sales are skyrocketing. Homemakers like the natural beauty of stainless — the way it easily absorbs the punishment of everyday use and stays forever new with a minimum of care.
• Sharon's thorough knowledge of the utensil industry, the ability to produce specification steels of consistent uniformity, plus the finest finishes in the industry are reasons why so many of the nation's leading electricware manufacturers specify Sharon Quality Stainless Steels.
SHARONSTEEL
For 56 Years a Quality Name in Steel
SHARON STEEL CORPORATION, SHARON, PENNA.
CHICAGO, CINCINNATI, CLEVELAND, DAYTON, DETROIT, GRAND RAPIDS, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, NEW YORK, PHILADELPHIA, ROCHESTER, SAN FRANCISCO, SHARON, MONTREAL, TORONTO

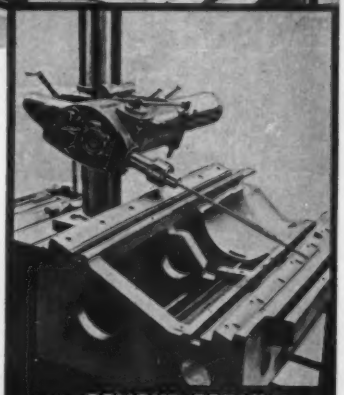
OERLIKON
UB 2
ALL ANGLE
PRECISION
BORER



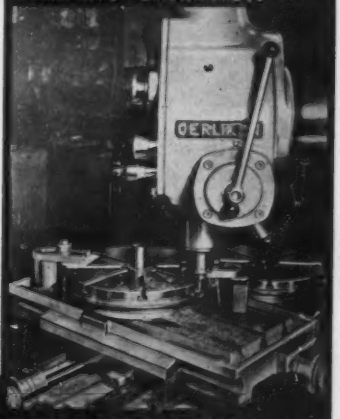
The UB 2 performs hundreds of general and specialized workshop operations—drilling, milling, countersinking, tapping, precision and center boring, reaming, facing, trepanning, etc.

- Radial swivelling arm combined with a freely swivelling head, allows handling of any job—even in awkward positions.
- Boring head can be canted to any angle (360°) and latched accurately in the vertical and horizontal positions.
- Spindle speeds variable from 30 to 3070 rpm.
- Travel of quill 6" with 3 powered feeds.
- A compound table for coordinate location makes the UB 2 a most useful tool room machine.
- Accessories include precision chuck, tapping head, collets holder, adjustable boring head, facing and turning head, trepanning tool, boring bars, etc.
- Portable—take it right to the job.

Write for detailed information and prices to:



▲ OBLIQUE DRILLING
MILLING OPERATION ▼



Mr. Frank Perret
c/o OLKON RESEARCH CORPORATION
630 Fifth Ave., New York 20, N. Y. • Tel.: Circle 6-0453
(Some exclusive territories still available)

some immunity to noise. Men who have worked for years in a boiler shop can get out a good day's work in spite of the clamor, but the progressive boiler shops are substituting welding for riveting, and rolling for peening, and other noise-eliminating techniques. These must result in an improved output at lower cost or they would quickly go into discard.

Noises that interfere with clear thinking are not necessarily loud bangs. A high-pitched screech upsets some men and erratic sounds cause others to stop what they are doing to wait for the final clunk. The first time I was in a very powerful supersonic tunnel laboratory I was surprised to notice that all the scientists were wearing earphones with a microphone attached. It was hard to understand why it should be that when a man wants to speak to another he had to talk into a microphone for I did not notice there was any particularly great noise in the large laboratory; just a powerful humming noise was all I seemed to hear. I spoke to one of the scientists and then to my astonishment found that while I had spoken in a very loud voice I failed to hear a word I had said. The man smiled and said something in return but I could hear nothing execpt the humming noise. We went into another laboratory where it was quiet and the scientist told me that it was impossible to talk to one another in the supersonic lab unless the microphone and ear phones were used, for the noise level in there was 125 decibels in spite of the fact that only a medium humming noise seemed to be present.

I found that everything possible

"Miller, you're not cost conscious, you're not safety conscious, you're not production conscious, you're not . . . ."

was being done to reduce this noise and get it under control. Sound insulation was being installed, acoustic tile was on the way to cover the walls and ceiling, rubber-tile floor was to be laid down and everything that vibrated was being dampened. Not only was the noise seriously interfering with the tests and experiments but almost everyone who was in the laboratory for even a short period of time developed a very nasty, short temper and became unduly quarrelsome and almost anxious to start a fight. Noises certainly can interfere with production and some of the more irritating noises do not sound to be at all extreme.

Shop noises can be reduced by using care and judgment. Press output instead of clinking down into a metal tote pan can be slid down a wooden chute into a wood-lined tote box; silent chain drives and noiseless gears can be installed; in fact, many noises can be completely eliminated, or greatly reduced, and these improvements will prove to be a good investment and pay nice dividends in better and greater production. In addition, the men will not become irritated and short-tempered.

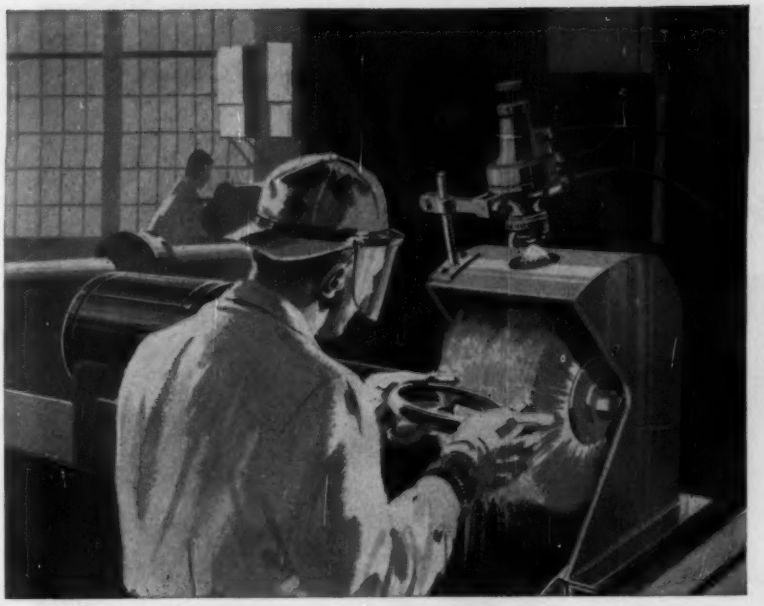
Ed should take all complaints about aggravating noises, fumes, too much dust, etc, quite seriously, for they all result in needless expenses, unnoticed perhaps but, nevertheless, very expensive.

George P Pearce
Albuquerque, NM

I feel that the only time that some shops don't sound like New Year's Eve is when they're closed—on New Year's Eve.

Very often this can't be helped but, likely as not, something can be done to curtail the irritation of the situation. If horses can wear foot protectors, and mules can wear sun reflectors, then why not supply people like Ritter with ear plugs?

Too quickly we are apt to blame the other fellow when the reformation should begin at home. The man who is complaining about the sounds of the other machines likes to do things the hard way. Instead of cleaning house himself he is attempting to get his neighbors to take the initiative. He preaches that they should do as he says but not as he does. It is the foreman's job to help him to view the situation from the

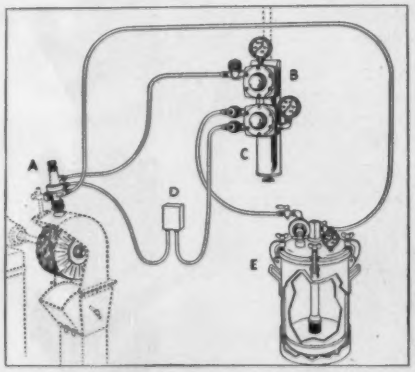


DeVilbiss spray guns make his buffing time fully productive

The time your operator spends in manually compounding, handling polishing and buffing bars is saved for productive work when compounds are spray-applied. And the DeVilbiss spray method offers the most efficient way to keep wheels properly conditioned for faster, consistently high-quality work!

Compounds are uniformly applied—in just the right amount—at the simple touch of a valve . . . or by means of an automatic control. The result: important savings in time and material. Waste through nubbins, and broken pieces is completely eliminated!

Call our nearest supplier for profit-saving information about DeVilbiss spray systems for polishing and buffing applications.



Complete DeVilbiss low-pressure "unit" system adapts to large or small manual or automatic installations. System includes (A) spray gun, (B) air transformer, (C) air regulator, (D) 3-way control valve, (E) pressure-feed tank, and hose.

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DEVILBISS HELPS YOU GET THE MOST FROM THE SPRAY METHOD

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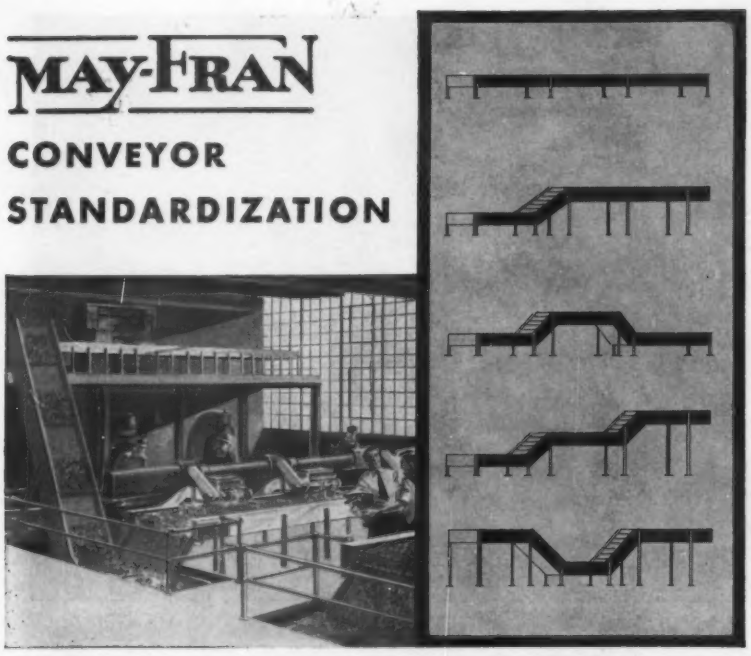

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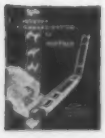
Here is a conveyor program designed for the unusual. NOW . . . you can have a customized conveyor today to meet production needs . . . and with modification, that same conveyor will meet the needs of tomorrow.

The May-Fran conveyor standardization program provides the standard components that can be assembled to form a special or standard conveyor. These same components can be re-arranged at any time to solve production problems in the future.

In addition, standard components mass produced mean conveyor economy right from the beginning.

Here is a conveyor program of standardization program that saves you money now . . . and in the future!



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7320-MP

MAY-FRAN ENGINEERING, INC.

1677 Clarkstone Rd., Cleveland 12, Ohio

best possible angle and adjust accordingly. If he still finds a bone of contention to pick on, Ritter ought to consider a solo job where noises are so low that no one can hear them.

Raymon Geraghty
Brooklyn, NY

Noise in the shop has always been looked upon and accepted as a necessary evil. It is regarded in much the same light as smoke in the air and pollution in the rivers. Some work has been done on the effect of noise on the health and efficiency of the worker, but as yet it is largely a matter of conjecture. The evidence from tests and experiments is not conclusive.

Many consider that the noise from machines in factories and, even typewriters in offices, is a real hazard to working capacity. It is definitely known that employment in the midst of machines and mechanical operations causes deafening, and that varied sounds that shock the auditory nerves produce a feeling of sensory fatigue. This is why deafness is so common among boilermakers. Although sensory fatigue attacks a single organ, it extends little by little to the whole nervous system and leads to a feeling of weariness. This type of fatigue reduces the production capacity of the worker to a greater extent than muscular fatigue.

It is quite understandable that a worker should complain about a

"I wasn't at all worried about the ten bucks, Ed. Here's your tools back."

from Johnson's Wax Research

A great idea changes old ideas about coolants

The use of waxes and wax-type synthetics brings coolants up from 1900 to 1957 standards! This great idea is a result of Johnson's Wax Research. Today, Johnson's Metalworking Fluids give superior performance wherever used for machining, grinding and forming. The tougher the job, the better Johnson's performs in comparison with conventional coolants . . . because Johnson's continues to lubricate and cool even under conditions where ordinary coolants fail because of extreme heat and pressure.

You'll find Johnson's in use in shops across the country with proven performance. See what they can do in your shop to reduce costs and to increase profits.

Johnson's complete line of Metalworking Fluids is available from your local Johnson's industrial distributor. Contact him today for an in-your-shop test. Ask him about Johnson's money-back *Guarantee of Superior Performance* over ordinary coolants.

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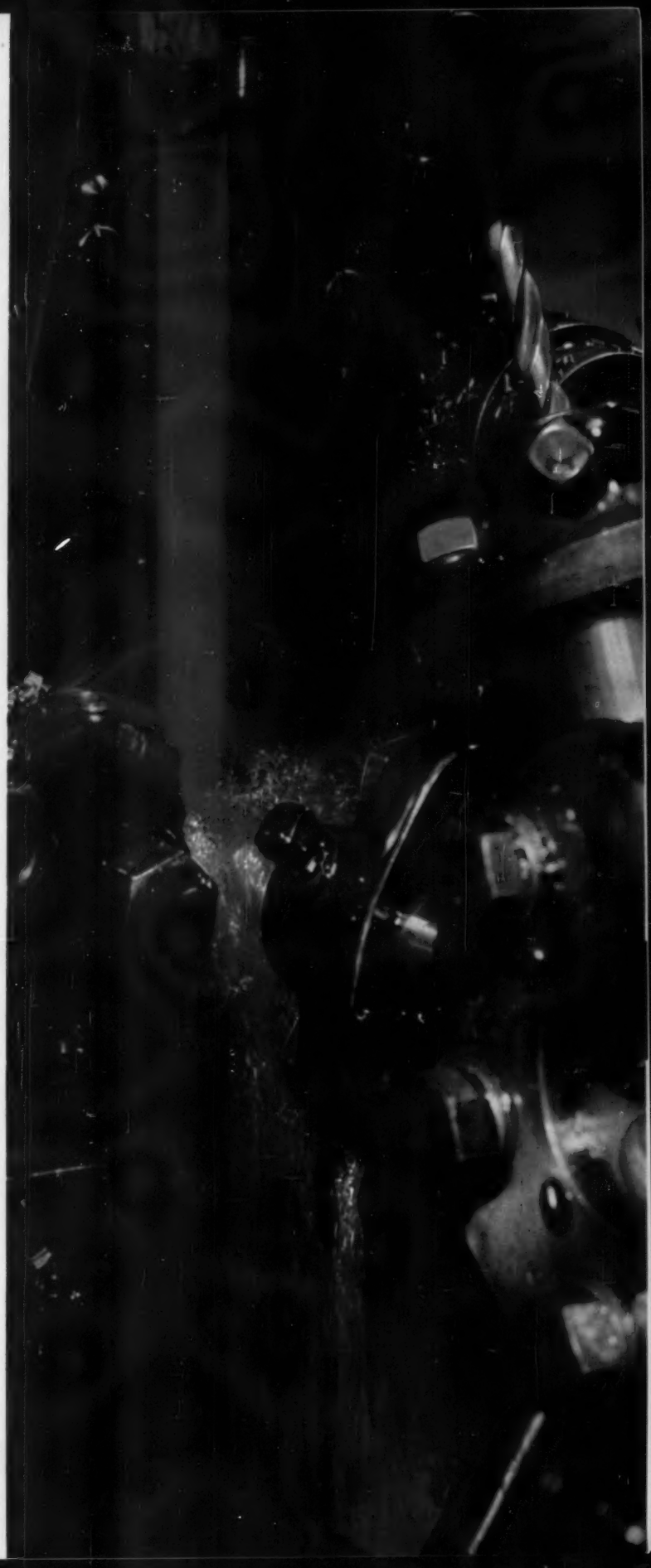
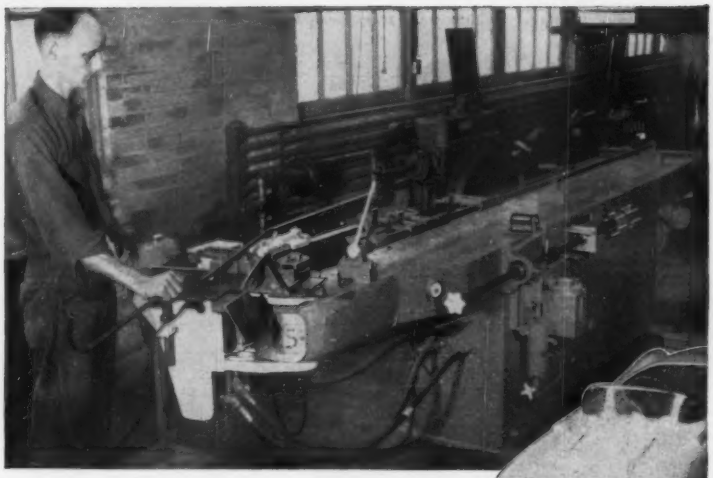


Pictured to the right is Johnson's WAX-CUT, one of the complete line of modern cutting fluids for today's high-speed automatics.

NET PRODUCTION

840 Bends Per Hour

With PINES HYDRAULIC BENDER

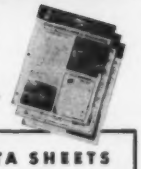


Over-all view of Pines Size ¾ Bender at Flexsteel Spring Division used for outside job work as well as for their own manufacturing needs. Application illustrates setup for bending long side members for toy Corvette car.

Automatic Cycling Speeds Job Work for Flexsteel Spring Division - Dubuque, Iowa

Here's another typical example of fast, efficient production bending illustrating the outstanding advantages of automatic cycling, a standard feature on most Pines machines. Flexsteel Spring Division, Northome Furniture Industries, Dubuque, Iowa, used this set-up to produce frames for a toy Corvette car from ⅝" 18-gauge welded steel tubing. Records show that over a period of three months, net production on workpiece illustrated averaged 140 pieces (840 bends) per hour. On this job requiring six bends of the same radii (1 13/16"), the operator simply positions the tubing for each bend and presses the forward button. Pre-set indexing stops automatically control the angle for each bend in sequence while the operator rapidly positions the workpiece. Automatic cycling saves valuable production time and accounts for the high efficiency rate maintained.

Simple positioning gauge determines plane of each bend. View shows position for making sixth bend for right-hand frame member. Both right-hand and left-hand members are produced on same setup.



Accuracy Maintained at High Production Speeds

Another well-known advantage of Pines machines is their ability to maintain accuracy. Tolerances of .030 to .040 at several check points are commonly held without difficulty, simplifying welding, assembly, or other fabricating operations. In addition, all Pines machines are designed for small radius bending with mandrels, as well as for bends of the type illustrated not requiring mandrels. For accuracy and efficiency, it will pay you to specify Pines.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

672 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

WRITE FOR *Free* DATA SHEETS

Ask for up-to-date case study material on production bending the "Pines-Way." Full information available, including tooling and setup data used for producing steel channels, rods, extrusions, pipe, and tubing. Or for assistance on any job, ask for a Pines sales engineer to call.

- 9" column; 3' or 4' arm
- spindle speed ratio of 40-to-1
- 12 speeds (up to 3200 rpm) through direct-reading dial
- automatic tapping reverse
- adjustable spring counterbalance (feel remains the same from lightest to heaviest tools)
- hardened tang slot
- safety elevating nut and screw (arm can't drop or overrun)
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- rigid accurate spindle mounted on 5 precision ball bearings

You can acquire this radial for only $.28 an hour, if you operate two 40-hour shifts, by using Gilbert's new financing plan: 6% simple interest (3% add on), up to 5 years to pay (subject to change)

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newest *high-speed* radial

Your many demands for a high-speed light-duty radial are met—completely and economically—by this new Gilbert 3 hp machine. Compare the features at the right with other radials of equal capacity, and you see why the Gilbert is the best buy in its class. Traditional Gilbert accuracy, fast response, and wide-angle work visibility make your shop more productive, more versatile. Variety of bases, runway mounting, or tables available. Get all the details in Bulletin 255.

The Cincinnati Gilbert Machine Tool Co.
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If your present method of sharpening small cutters is

..SLOW, INACCURATE, COSTLY—

GIVING POOR CUTTING EDGE AND FINISH—

CAUSING RUN-OUT IN SHARPENED CUTTERS—

CONSUMING TOO MUCH TIME CHANGING SETUPS—

TYING UP A LARGE EXPENSIVE MACHINE FOR SMALL WORK—

YOU NEED A END MILL **CENTRA·POINT** GRINDER ®

Centra • Point's 12 advanced features *really can* overcome all these problems by mechanically performing functions which are troublesome and time-consuming on standard grinders. For full details write today for Bulletin M-55.

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SINCE 1880

326 Dorchester Ave., Boston 27, Mass.

noisy machine in the shop, even though the machine he operates is noisier. He is operating his machine and knows when to expect the noise; it does not come to his ears as a surprise. In addition, some types of noise are more objectionable than others. The deep-pitched rumble of a heavy press is not as objectionable as the ringing sound produced when a steel bar is dropped, even though the press noise is louder.

There are many who claim that vibrations are more disturbing to the nervous system than noise. It is hardly possible to eliminate the noise from machines, but a great deal can be done to reduce it. Resilient mountings, partitions, and the use of sound-deadening wall-coverings are all helpful. Vibrations can be reduced by better machine arrangement and solid foundations.

In past years attention and research has been concentrated on bigger, better, and faster machines. These efforts have been successful as evidenced by the greater productivity of today's machines over those of a few years ago. Along with this progress has been a steady increase in safety consciousness. An accident produces an undesirable but readily measurable result.

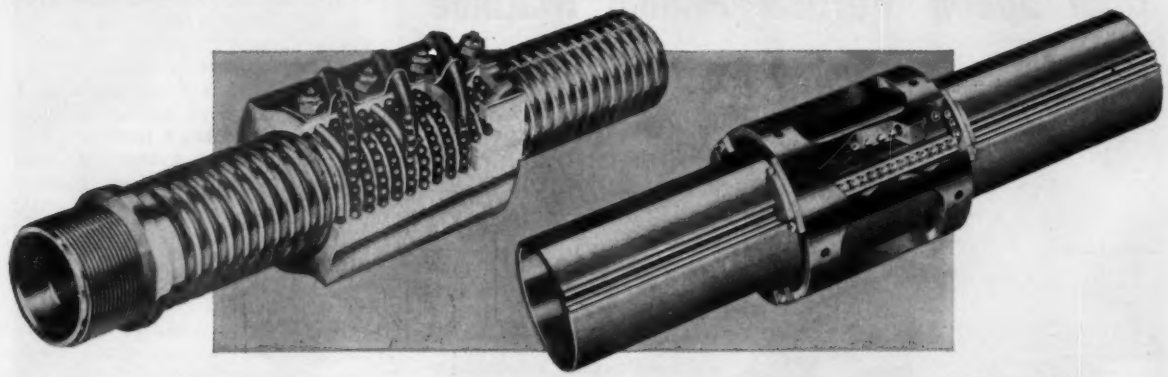
The damage to the human system from noise is not readily discernible. Nevertheless it is there, and it is real. It is serious and is growing worse as machines get bigger and run faster. Let us have more attention paid to this significant problem.

H George
Yonkers, NY

"It's a week now since you got a raise . . . let's not run this thing into the ground!"

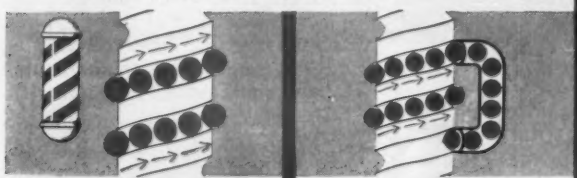
These MODERN Recirculating Ball Units can help you...

SOLVE ACTUATION and TORQUE PROBLEMS



Saginaw b/b Screws guaranteed 90% efficient —offer 6 major advantages for designers

Available in custom machined and commercial rolled thread types—have been built from 1½ inches to 39½ feet long—⅜ to 10 inches diameter.



Nut *glides* on steel balls. Like stripes on a barber pole, the balls travel toward end of nut through spiral "tunnel" formed by concave threads in both screw and mating nut.

At end of trip, one or more tubular guides lead balls diagonally back across outside of nut to starting point, forming closed circuit through which balls recirculate.

1 VITAL POWER SAVINGS. With guaranteed efficiency of 90%, Saginaw b/b Screws are up to 5 times as efficient as Acme screws, require only ⅕ as much torque. This permits much smaller motors with far less drain on the electrical system. Circuitry is greatly simplified.

2 SPACE/WEIGHT REDUCTION. Saginaw b/b Screws permit use of smaller motors and gear boxes; eliminate pumps, accumulators and piping required by hydraulics. In addition, Saginaw b/b Screws themselves are smaller and lighter. Units have been engineered from 1½ in. to 39½ ft. in length.

3 PRECISE POSITIONING. Machine-ground Saginaw b/b Screws offer a great advantage over hydraulics or pneumatics because a component can be positioned at a predetermined point with precision. Tolerances on position are held within .0006 in./ft. of travel.

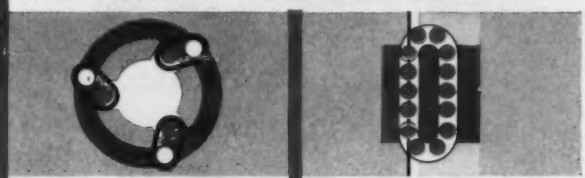
4 TEMPERATURE TOLERANCE. Normal operating range is from −75° to +275° F., but assemblies have been designed in selected materials which function efficiently as high as +900° F. These units are practical where hydraulic fluids have lost efficiency or reached their flash point.

5 LUBRICATION LATITUDE. Even if lubrication fails or cannot originally be provided because of extreme temperatures or other problems, Saginaw b/b Screws will still operate with remarkable efficiency. Saginaw units have been designed, built and qualified for operation without any lubrication.

6 FAIL-SAFE PERFORMANCE. Far less vulnerable than hydraulics. In addition, Saginaw offers three significant advantages over other makes: (1) Gothic arch grooves eliminate dirt sensitivity, increase ball life; (2) yoke deflectors and (3) multiple circuits provide added assurance against operating failure.

Saginaw b/b Splines average 40 times lower friction coefficient than sliding splines

Transmit or restrain high torque loads far more efficiently—have been built from 3 inches to 10 feet long—⅜ inch to 6 inches in diameter.



The *Saginaw b/b Spline* radically increases the efficiency of transmitting or restraining high torque loads. Instead of *sliding* against each other, surfaces *glide* on rolling balls.

The steel balls recirculate in closed circuits formed by mating longitudinal raceways spaced around the circumference of inner and outer splines. Guides return balls.

This revolutionary new kind of spline utilizes the same basic principle pioneered by Saginaw in the ball/bearing screw.

It permits new engineering designs never before practical—literally lets you achieve the "impossible"! In any application where column length must change under torque load, the Saginaw b/b Spline offers greatly decreased friction, less wear, longer life, more dependable operation. It can be fitted with integral gears, clutch dogs, bearing and sprocket seats or a wide choice of other attachments for use with electric, hydraulic or pneumatic units. To convert push-pull to rotary motion, helical types are available with very high leads, ranging from 20:1 to 100:1.

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Saginaw ball bearing Screws and Splines

SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS

WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES

Saginaw Steering Gear Division
General Motors Corporation
b/b Screw and Spline Operation
Dept. 4R, Saginaw, Michigan

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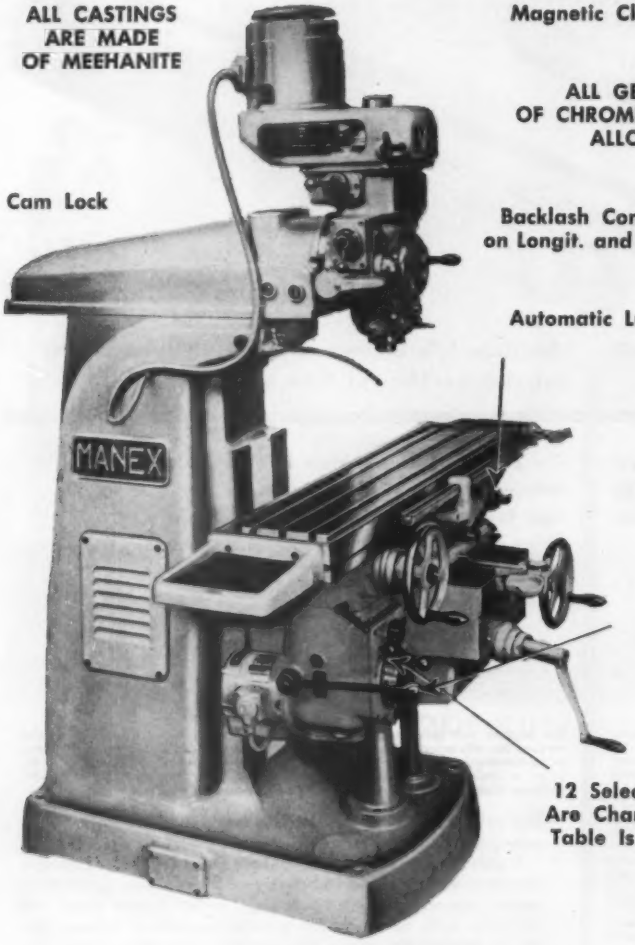


SADDLE 30" Long

Rapid Traverse

12 Selective Feeds Are Changed While Table Is In Motion

SPECIFICATIONS

TABLE	36" - 42" - 48"	Electro-pump	¼ H. P.
Longitudinal feed	26" - 30" - 38"	Maximum distance spindle to table	18"
Width	10"	Maximum distance spindle to column	25"
Cross feed	10"	12 DIAL TYPE table feeds	7/16" to 19⅛"
8 Spindle speeds	75-2850 r. p. m.	RAPID TRAVERSE	100" p. m.
3 automatic feeds	.0015" - .003" - .006"	Micrometer depth stop graduated in .001"	
Quill travel	5"	Large dials graduated in .001"	
Head traverse travel	13"	Brake inside pulley stops spindle instantly	
Motor for Spindle	2 H. P.	Motor and pulley dynamically balanced.	
Motor for table feed	½ H. P.	Net weight (approx.)	2750 Lbs.
Saddle	30"	Base	40" x 25"

MANEX

MACHINERY CORPORATION

204 Central Park South New York 19, New York

Names in the News . . .

R A Canning has been appointed manager of manufacturing of the newly formed Magnetic Materials Section of General Electric's Metallurgical Products Department. **R J Studders** has been named manager of engineering; **Max E Hartl,** marketing manager; and **Anthony J Gizzi,** manager of the specialty resistor project.

Andrew F Haiduck, executive vice president in charge of manufacturing for Lear, Inc, Santa Monica, Calif, has been named to the newly created post of executive vice president of the company.

Robert G Hill has been promoted from sales engineer to sales manager of the Original Equipment Division of the Leece-Neville Co, Cleveland.

R L Greene, assistant sales manager of Parker Rust Proof Co, Detroit, has been made head of special products sales; he will supervise all activities in connection with aluminum treatments marketed by Parker.

Rolf H Berg, Atols Tool & Mold Corp, Chicago, has been elected president of Chicago's 32-year-old Tool & Die Institute. **Stanley B Hill** of Kleen-Kut Stamp Works, Inc, has been named vice president.

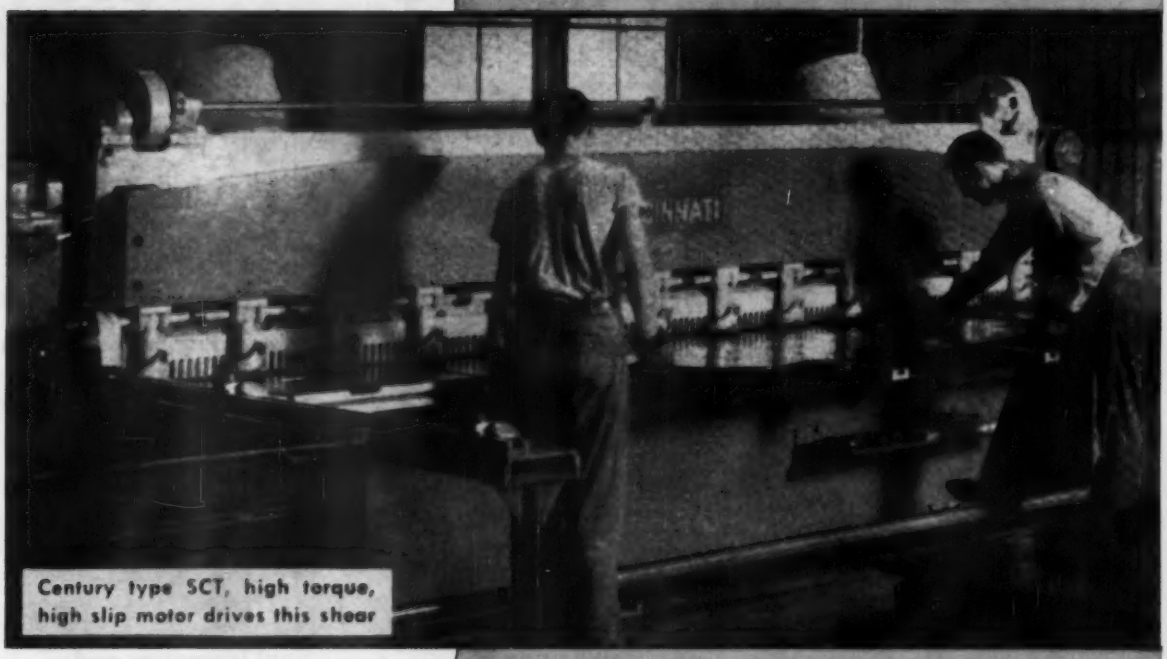
John A Robertshaw, Jr, an assistant vice president of Robertshaw-Fulton Controls Co, has been elected a vice president of the company.

E J Legant, plant superintendent of General Motors' Fisher Body Plant No. 2 at Flint, Mich, has been shifted to Oakland, Calif, as plant superintendent of the Fisher facility there.

Oscar L Joseph has been named plant manager of the Ann Arbor plant of Associated Spring Corp's Barnes-Gibson-Raymond Division. Formerly purchasing agent of the Plymouth plant, he succeeds **Melvin E Donally,** who has retired.

M C Copold has been appointed chief of manufacturing development for Convair (San Diego), a Division of General Dynamics Corp. He was formerly supervisor of manufacturing development at Plant Two.

designed to absorb heavy peak load...



Century type SCT, high torque, high slip motor drives this shear

Century

Performance-Rated® MOTOR EXACTLY FITS THE NEED ON THIS SHEAR

To get full value from your equipment, motor *performance* must match machinery *requirements*. Whether the horsepower need is large or small, Century Performance-Rated Motors can supply the performance characteristics you require.

This shear has a Century Motor selected for proper size, speed, and torque with "high slip" characteristics. When the clutch is actuated, energy stored in the flywheel during the idle part of the cycle is used to drive the shear. As the load comes on, the motor speed pulls down—thus cushioning the shock of the load. This saves impact on the shear and motor, reduces power line surge and permits use of a Century Motor *Performance-Rated* to do the job without excess horsepower.

Century Performance-Rated Motors are designed in a wide range of torque, speed, mounting and frame characteristics. Call your nearby Century authorized distributor, or contact our District Sales Office.

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6 reasons for checking your Commercial Heat Treater First

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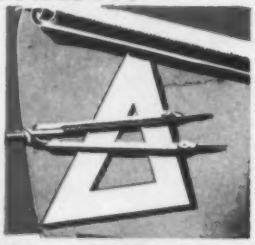
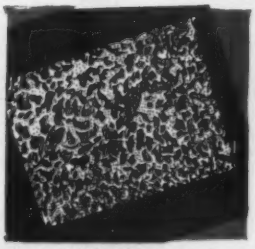
1



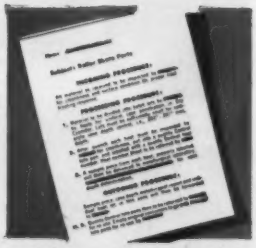
Guidance in Steel Selection and Design

2



Metallurgical Understanding of Metal Properties

3

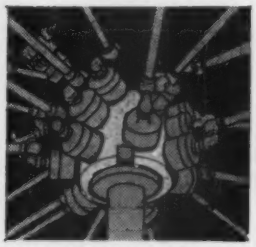


Assistance in Proper Preparation of Parts for Heat Treating

4

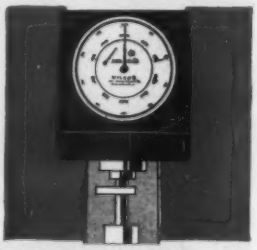
Knowledge through Experience of the Right Heat Treat for the Job

5



Extensive array of Equipment and Facilities

6



Final laboratory and non-destructive Testing

Whenever your production requirements for a new product or the redesign or improvement of an old one mean the installation or expansion of heat treating activities, it will pay you to check with your Commercial heat treater before tackling the job yourself.

The 6 basic reasons for this are shown above. Remember the Commercial Heat Treater has the skill, the experience, the equipment;—all under one roof ready to serve you.

THERE'S A HEAT TREATING SPECIALIST NEAR YOUR PLANT

American Metal Treatment Co.
Elizabeth, N. J.
Anderson Steel Treating Co.
Detroit, Michigan
B. & W. Precision Heat Treating Co.
Kitchener, Ontario, Canada
Benedict-Miller, Inc.
Lyndhurst, New Jersey
Bennett Heat Treating Co., Inc.
Newark 3, New Jersey
Commercial Metal Treating, Inc.
Bridgeport, Conn.
Cook Heat Treating Co. of Texas
Houston 11, Texas
The Dayton Forging & Heat Treating Co.
Dayton 3, Ohio
Domlay Heat Treating Corp.
Dallas, Texas
Drever Company
Philadelphia 33, Pennsylvania
Greenman Steel Treating Company
Worcester 5, Massachusetts

MTI MASTER CRAFTSMEN METAL TREATING INSTITUTE

Fred Heinzelman & Sons
New York 12, New York
Alfred Heller Heat Treating Co.
New York 38, New York
Hollywood Heat Treating Co.
Los Angeles 38, California
L-R Heat Treating Company
Newark, New Jersey
The Lakeside Steel Improvement Co.
Cleveland 14, Ohio
Metallurgical, Inc.
Minneapolis 14, Minnesota
Metallurgical, Inc.
Kansas City 8, Missouri
Metlab Company
Philadelphia 18, Pennsylvania

New England Metallurgical Corp.
South Boston 27, Massachusetts
Paulo Products Company
St. Louis 10, Missouri
Pittsburgh Commercial Heat Treating Co.
Pittsburgh 1, Pennsylvania
The Queen City Steel Treating Co.
Cincinnati 25, Ohio
J. W. Rex Company
Lansdale, Pennsylvania
Stanley P. Rockwell Company
Hartford 12, Connecticut
C. U. Scott & Son, Inc.
(Stainless Steels)
Rock Island, Illinois
Standard Steel Treating Co.
Detroit 10, Michigan
Syracuse Heat Treating Corp.
Syracuse, New York
Winton Heat Treating Company
Cleveland 16, Ohio

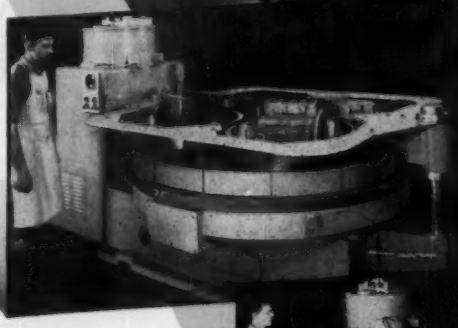
in this line-up . . .

Model 12 handles 3
4-in. dia. parts up to 705
¼-in. dia. parts per load.

Model 24 handles 3
9½-in. dia. parts up to 3900
¼-in. dia. parts per load.

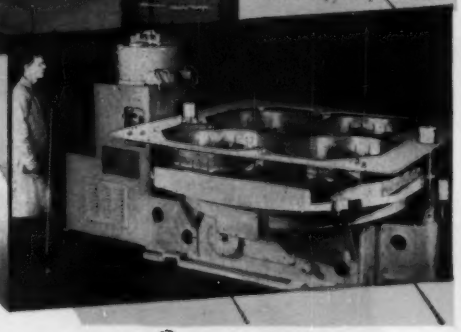
Model 36 handles 4
13¾-in. dia. parts up to 4000
⅜-in. dia. parts per load.

Model 48 handles 4
17-in. dia. parts up to 940
1-in. dia. parts per load.



Model 72 handles 4
27-in. dia. parts up to 2480
1-in. dia. parts per load.

Model 84 handles 4
32-in. dia. parts up to 3500
1-in. dia. parts per load.



there's a specific *Lapmaster*® to give you:

1 *Precision Flatness*

2 *and Finish*

in production quantities

Parts large or small—tall or squat—whatever the case may be, there's a Lapmaster tailor-made to meet your production requirements at the lowest possible cost per piece.

If you are now lapping by other means—hand scraping or grinding—it will pay you to investigate the Lapmaster. Our fully equipped lapping laboratory is at your disposal to analyze your problem, test run a number of pieces and furnish you with a complete production report without obligation.

"John Crane" Lapmasters are capable of consistently producing flatness to less than one light band (11.6 millionths of an inch), micro-inch finishes of 2 to 3 RMS on all materials including cast iron, steel, magnesium, aluminum, brass, carbon, ceramics and plastics.

Crane Packing Company, 6436 Oakton St., Morton Grove, Ill. (Chicago Suburb).
In Canada: Crane Packing Co., Ltd. 617 Parkdale Avenue, Hamilton, Ontario.

Free data

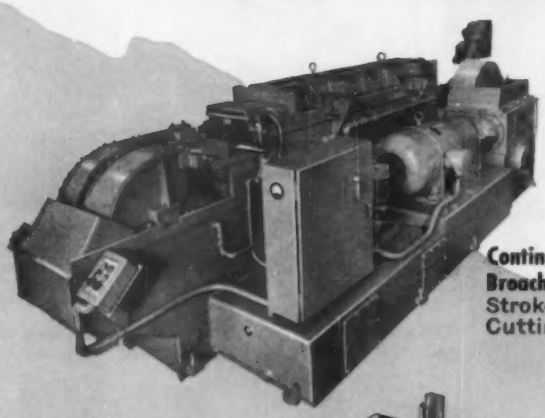
These 3 booklets on Production Lapping and Light Band Reading are yours for the asking. Write today.

John Crane

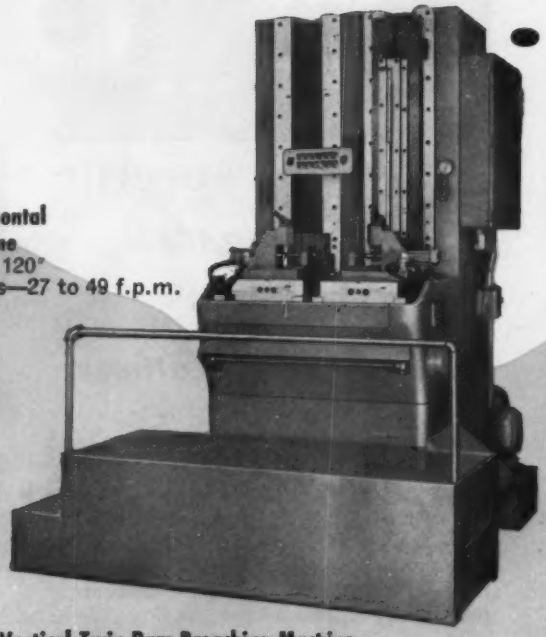
MECHANICAL PACKINGS | SHAFT SEALS | TEFLON PRODUCTS | LAPPING MACHINES | THREAD COMPOUNDS

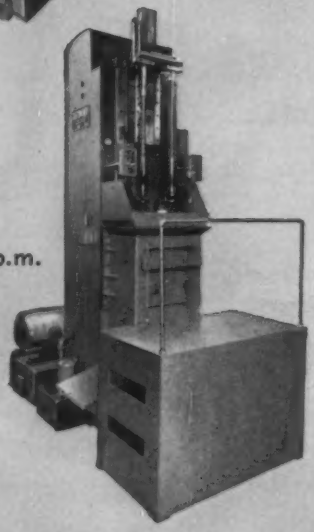
CRANE PACKING COMPANY

Your Best Investment
for Today's and Tomorrow's Production



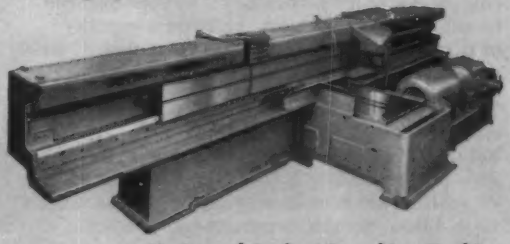
Continuous Horizontal Broaching Machine
Stroke—42″ to 120″
Cutting Speeds—27 to 49 f.p.m.



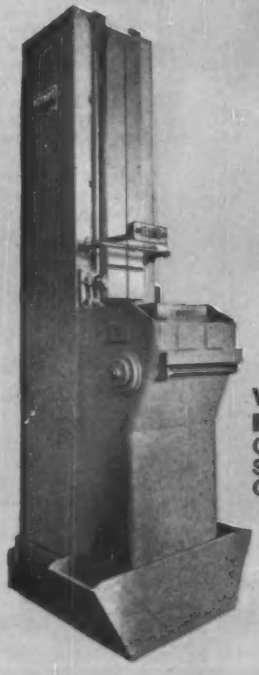


Vertical Pull-Down Broaching Machine
Capacity—5 to 50 tons
Stroke—30″ to 72″
Cutting Speeds—4 to 35 f.p.m.

Vertical Twin Ram Broaching Machine
Capacity—5 to 25 tons
Stroke—30″ to 100″
Cutting Speeds—4 to 35 f.p.m.



Horizontal Surface Broaching Machine
Capacity—10 to 50 tons
Stroke—90″ to 240″
Cutting Speeds—15 to 300 f.p.m.



Vertical Single Ram Broaching Machine
Capacity—5 to 25 tons
Stroke—30″ to 90″
Cutting Speeds—4 to 35 f.p.m.

Horizontal Internal Broaching Machine
Capacity—3 to 50 tons
Stroke—6″ to 90″
Cutting Speeds—4 to 35 f.p.m.

NOTE—All capacities, strokes and cutting speeds given are for standard machines and will be varied to suit your requirements.

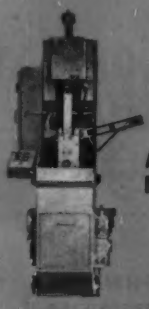
Requirements . . DETROIT Broaching Machines

You want machines for *today's* production to be rugged . . . built to deliver high output consistently, without costly shutdowns. *But look to the future as well!* Be sure that these machines are also designed with maximum versatility . . . so they'll be readily adaptable to model changes for *tomorrow's* production, too.

Detroit machines meet these requirements because they are:

- **RUGGED . . . take overloads 50% over rated capacity.**
- **FLEXIBLE . . . easily retooled for part or model changes.**
- **DEPENDABLE . . . rigid construction and stabilized hydraulic circuits assure consistent high production.**
- **SIMPLE . . . easy to operate, easy to maintain.**
- **VERSATILE . . . available with manual, semi-automatic or full automatic control plus automatic tool handling.**
- **PRECISE . . . total ram runout less than .0005" through strokes as long as 100".**
- **FOOLPROOF . . . full interlocking protects machine and tooling. All electrical and hydraulic equipment to J.I.C. standards.**

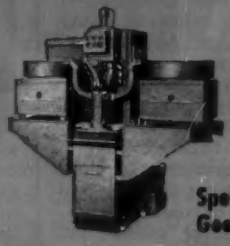
To make the best investment for today *and* tomorrow, consult our Engineering Department. They'll recommend the right high-capacity, high-performance Detroit machine to solve your problem, along with complete tooling and automation if required. Send parts, prints or details of your problem now.



Automatic Side Plate Press

Special Automatic Assembly Press

Side Plate Press



Special Automatic Gooseneck Press

(Ask us to quote on any of your hydraulic press applications.)

DETROIT BROACH & MACHINE COMPANY
DEPT. A-3, ROCHESTER, MICHIGAN

Please send me free literature on:

- ☐ Continuous Horizontal Broaching Machine
- ☐ Horizontal Surface Broaching Type
- ☐ Single Ram Vertical Type
- ☐ Twin Ram Vertical Type
- ☐ Pull-Down Vertical Type
- ☐ Broaching Tooling
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BRIDGEPORT BRASS

COPPER ALLOY BULLETIN

Bridgeport Reporting New Developments in Copper-Brass Alloys and Metalworking Methods

TIPS ON MACHINING DURONZE (ALUMINUM-SILICON BRONZE) ROD

by M. A. BUELL
Chief Staff Metallurgist

Our general designation for silicon bronze rod is Duronze. Duronze 707 is one of these alloys and contains 91.0% copper, 7.0% aluminum and 2.0% silicon. This composition makes Duronze a tough, strong and corrosion-resistant alloy suitable for a variety of applications, such as gears, pump parts, pinions, valve parts, etc.

It is this toughness which has to be considered when machining Duronze 707. Although the chip is brittle, its tensile strength is 50% greater than that of leaded brass. Consequently, extra machining power is required. Likewise, tools of a high degree of hardness, such as carbide-tipped tools, should be used. The tools should be set on center, or slightly below, to insure correct front clearance. Any rubbing will result in rapid wear to the tools. Above all, sharp tools are essential.

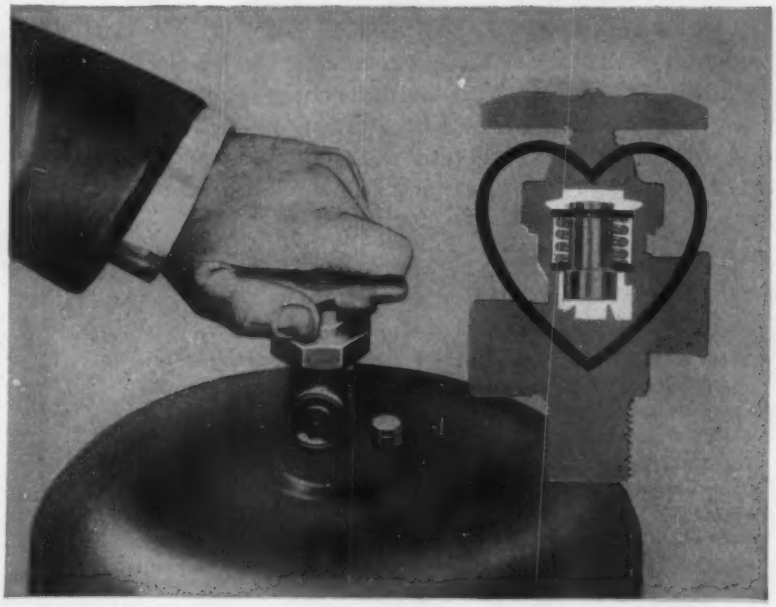
Cooling is most important when machining Duronze 707. The heat build-up, due to friction between the tool and the metal, is considerable. Consequently, the heat must be dissipated with a plentiful flow of coolant. A low-viscosity mineral oil of around 100 Saybold seconds is generally satisfactory. Sulphurized mineral oil can also be used but tends to stain.

Deep cuts should be avoided, but can be handled without trouble by splitting the operation into roughing cuts and finishing cuts. This procedure also helps increase accuracy and helps improve surface finishes since it tends to variations in dimensions and surfaces.

An article of this nature commonly high lights some of the topics involved. More complete information on specific problems—whether on Duronze or any other copper alloy—can be obtained by writing or phoning your nearest Bridgeport Sales Office. Our field men will be glad to serve you.

Propane Valve Uses Duronze* "Heart" For Extra Strength And Trouble-Free Service

*Aluminum-silicon bronze



The cylinder valves that regulate LP gas in home systems must have tough construction, be easy to operate and offer maximum safety. To fill these needs, the Aluminum and Brass Co., Inc. of Lockport, N. Y. makes high-quality propane valves that use Bridgeport's Duronze 707 Alloy for the lower stem assembly—the "heart" of the valve.

Duronze Requirements

These stems must really take it—stand up under severe service, be unaffected by sudden temperature changes and also resist corrosion to avoid freezing or sticking. To meet these tough material requirements, the manufacturer specified Duronze 707—a high-strength, aluminum-silicon bronze alloy that can also be machined to the close tolerances needed for the valve parts.

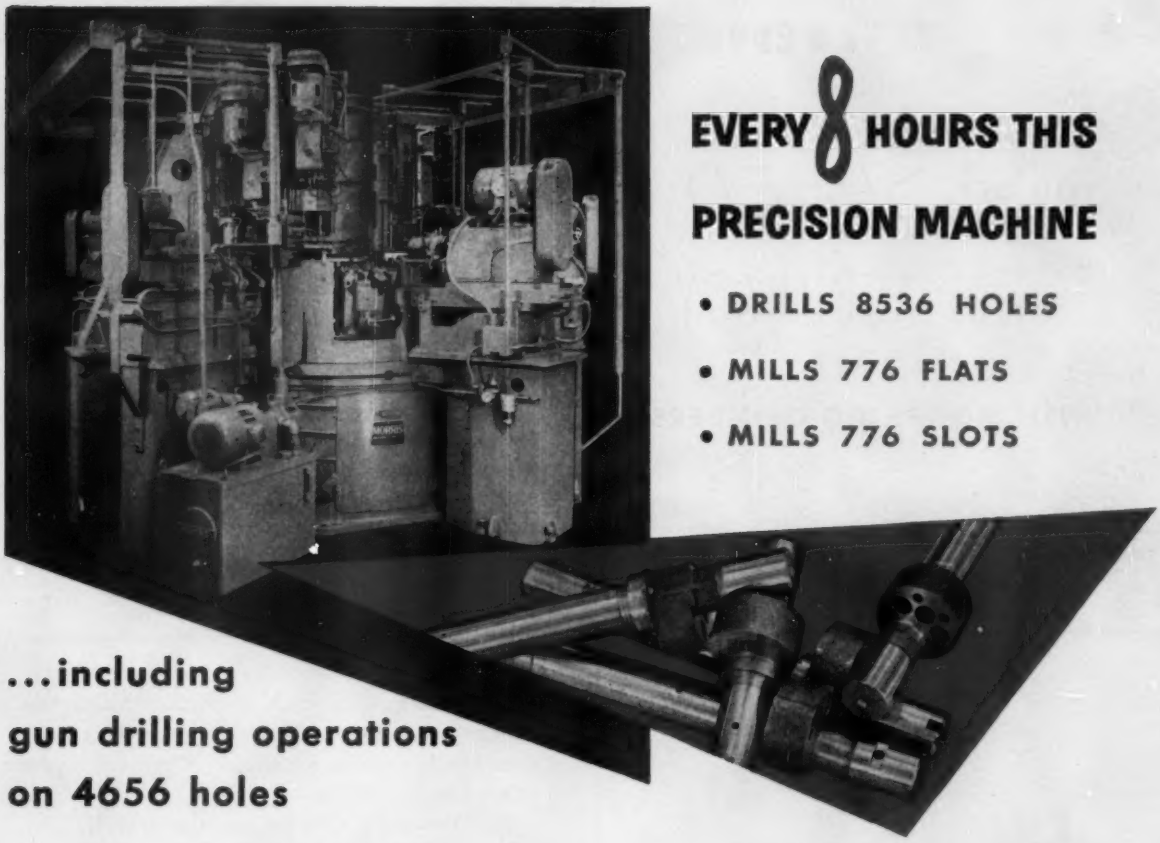
Solving the Problem

Before Duronze was used, the lower valve stem was made of brass. The constant shutoff action of the valve exerted a crushing pressure on the stem, which in turn developed a concave area in the brass seating member and prevented a gastight seal. Because Duronze is not affected by this shutoff action, this problem has been eliminated.

Matching Metal to Job

These propane valves are another example of how Bridgeport matches the metal to the job. By working closely with the manufacturer, the Bridgeport salesman was able to meet his specifications exactly and help contribute to the over-all superiority of the product. The Bridgeport salesman who calls on you, or our nearest sales office, is always ready to offer you the same service on your products. Call them to use this service to your advantage.

BRIDGEPORT BRASS
Bridgeport Brass Company, Bridgeport 2, Connecticut, Offices in Principal Cities
In Canada: Noranda Copper and Brass Limited, Montreal



EVERY 8 HOURS THIS PRECISION MACHINE

- DRILLS 8536 HOLES
- MILLS 776 FLATS
- MILLS 776 SLOTS

...including gun drilling operations on 4656 holes

...all automatically!

This MORRIS Model 322-S High Production Machine produces 97 refrigeration compressor crankshafts per hour at 80% efficiency. In each part it automatically drills 11 holes, varying in diameter from .125″ to .375″. Six holes, including one hole 4¾″ deep, are drilled using gun drilling techniques. In addition, the machine mills one end slot and one chordal flat on the shaft.

These operations are coordinated through use of a MORRIS basic center column machine, equipped with a 48″ dia. table, a 12-station automatic indexing mechanism, and 16 MORRIS AIR-OIL-Matic and Cam-Matic Drill Units.

The result is a completely automatic "special" machine, designed using a standard basic machine and standard drill units . . . at a fraction of the usual special machine cost. The machine may be altered for model changes, without scrapping a complete machine.

Investigate the production-boosting and cost-saving advantages of MORRIS Unit-Type High Production Machine Tools. WRITE TODAY for detailed literature, or outline your production problem for analysis by MORRIS engineers.

See our insert in Sweet's Machine Tool File

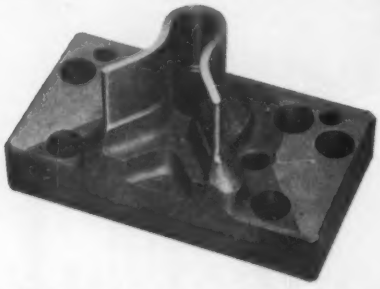
Collins MOR-SPEED Line — Morris

MACHINE TOOL COMPANY
933 HARRIET STREET
CINCINNATI 3, OHIO

YOU GET *SPEED* PLUS ACCURACY WITH MOORE JIG GRINDERS

HOLES from 1/64" to 8" Relocated and Ground within .0001" in One-Third Previous Time

Before hardening, this two-station die block was Moore-Jig-Bored to eliminate the need for excessive grinding. After hardening and surface grinding, all holes were Moore-Jig-Ground to exact size and location. Blank hole and center piercing hole were ground with ½° included taper. Little clearance could be allowed between punch and die. Jig grinding time: *only 2¾ hours.*



CONTOURS, Too, Accurately Jig Ground and Checked in One Setting

This flanged punch, impractical to grind by any other method, was a natural for the No. 2 Moore Jig Grinder. All radii—male and female—were ground accurately to location and size. The piece, having been set up on a rotary table, was aligned to permit grinding of the angular surfaces. And the entire contour was inspected by the "indicator measuring" method while the punch was still on the machine.

The word "versatile" must have been coined for the No. 2 Moore Jig Grinder. Not only does this machine relocate and grind straight and tapered holes with ease, but it contour grinds, chop grinds and slot grinds just as skillfully.

The Moore Jig Grinder, together with its toolroom teammate, the Moore Jig Borer, enables tool and die sections to be produced concurrently, puts diemaking on an interchangeable-parts-and-assembly basis. And it's also a time-saver on production jobs.

Employing the accurate lead screw measuring principle and a convenient system of coordinate hole location, the fast and sure Moore Jig Grinder eliminates hours of checking on bench and surface plate.

Why not find out how this remarkable machine can save *you* sizeable chunks of time and money. Write today for our detailed bulletin.

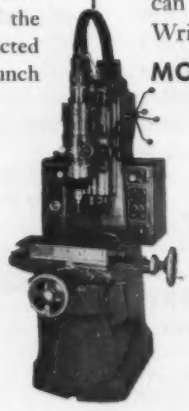
MOORE SPECIAL TOOL COMPANY, INC.
738 Union Ave., Bridgeport 7, Conn.

"HOLES, CONTOURS AND SURFACES

is bound to become a classic to the man or shop that does accurate work."

American Machinist Book Review

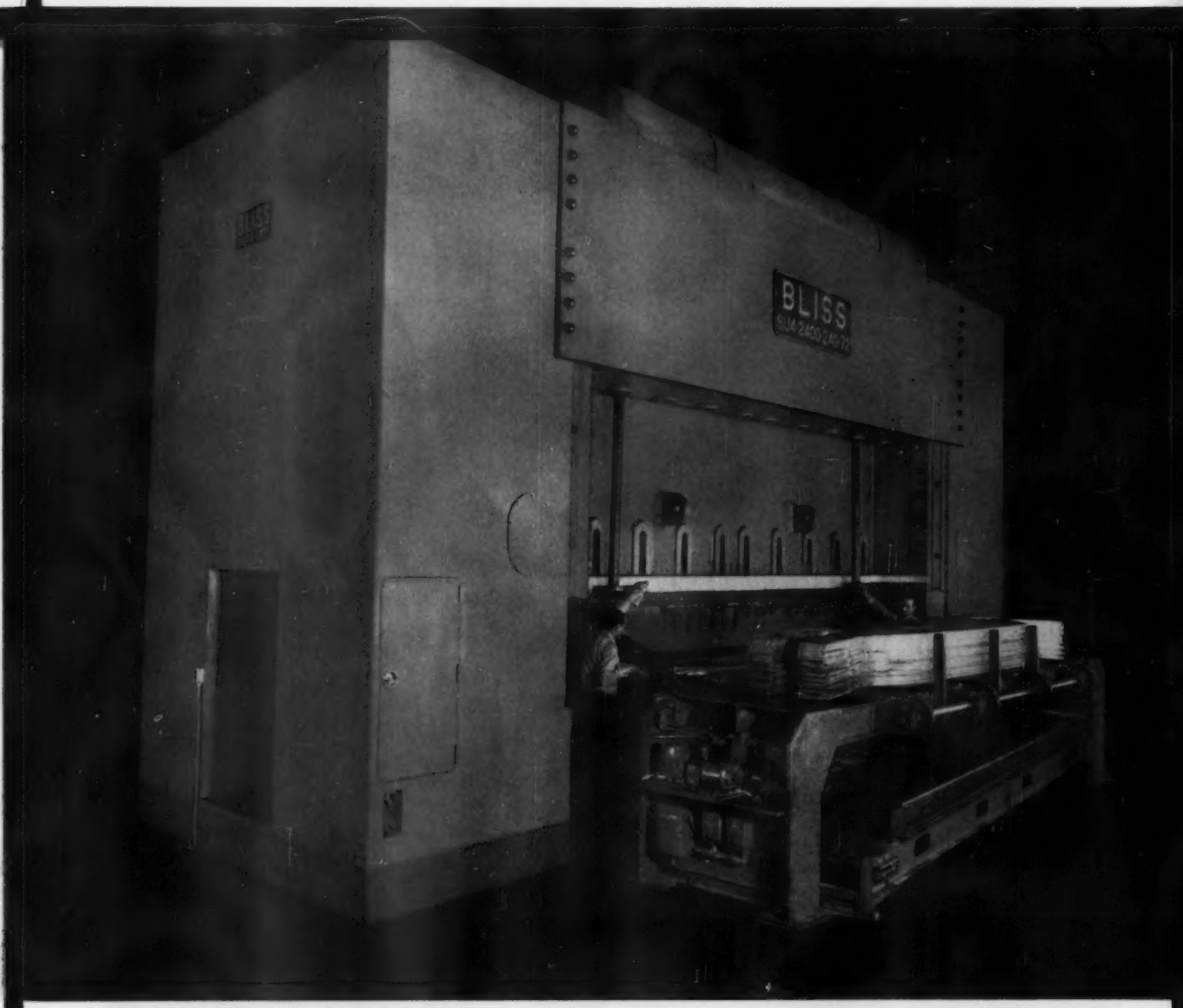
424 pages—$5 U.S.A., $6 elsewhere



NO. 2 MOORE JIG GRINDER
Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up and down; spindle-housing heat control. Features slot grinding attachment.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES



LOW, WIDE and HANDSOME

. . . it's the largest of its kind in the world

This is the largest mechanical underdrive press in the world. It is 40 feet long, 20 feet above floor level, 22 feet below, and has a capacity of 2400 tons.

And what a job it does! At the Reading, Pa., plant of Parish Pressed Steel Company, it stamps out 20-foot-long auto chassis side rails from thick hot-rolled steel blanks... two per stroke, sixteen per minute. Or, by using the cushion between the openings in the uprights, it produces 30-foot-long truck chassis rails.

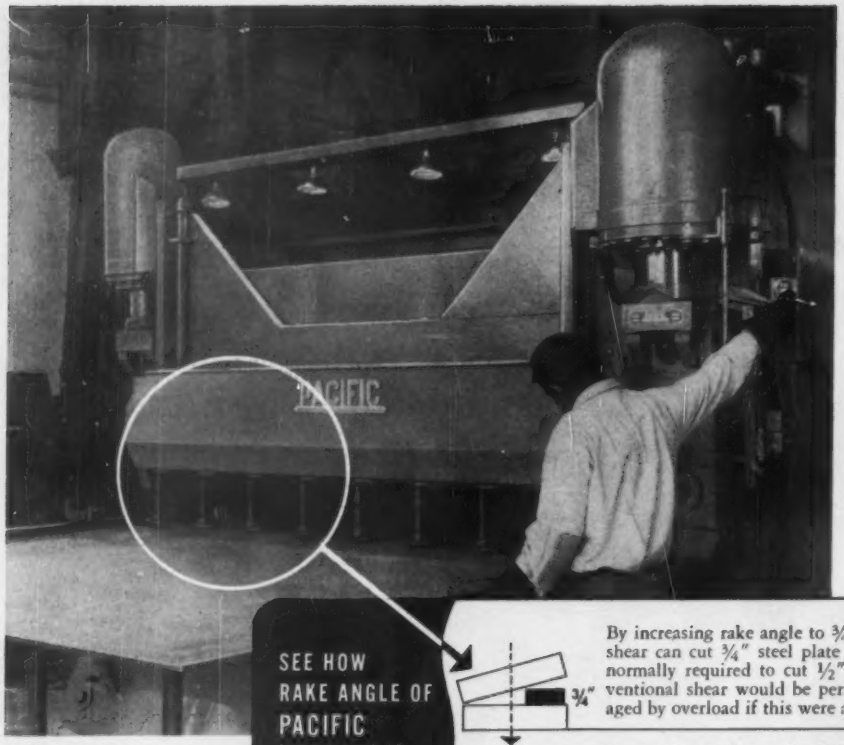
Like Parish, many a firm is shifting to underdrives wherever it can. Their low silhouette fits into one-story plants. And with the entire drive "down under"—below the working floor — maintenance becomes simpler and faster. It's the modern press for the modern plant. In other words, it's Bliss.

BLISS
SINCE 1857

100 years of making metal work for mankind

E. W. BLISS, COMPANY, Executive Offices, Canton, Ohio

Presses • Rolling Mills • Mill Rolls • Can Machinery • Die Sets • Ordnance



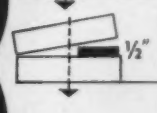
Adjusting Pacific rake angle by hand control lever

NOW...

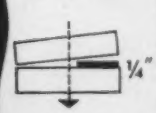
a ½" shear adjustable to cut full length ¾" plate continuously

SEE HOW RAKE ANGLE OF PACIFIC HYDRAULIC SHEAR IS CHANGED FOR PERFECT SHEARING OF ANY THICKNESS OF METAL

By increasing rake angle to ¾" per foot the shear can cut ¾" steel plate with the force normally required to cut ½" plate. A conventional shear would be permanently damaged by overload if this were attempted.



In cutting rated capacity (½"), sheer cuts exactly the same as conventional fixed rake angle shear.



In cutting ¼" steel, the rake angle is reduced to 3/32" per foot and the shear will cut strips 24" long up to 60 per minute with less twist and bow than with any conventional shear.

ABOVE, RIGHT: *¼" plate cut with Pacific adjustable rake shear*

ABOVE, LEFT: *¼" plate cut with conventional shear*

Rugged Pacific Hydraulic Shear cuts steel from 20 gauge to ¾" plate with single knife clearance. For precision cutting, knife clearance can be adjusted in 30 seconds to match plate thickness. Pacific Hydraulic Shear cuts noiselessly without shock. Knives last 2 to 3 times longer . . . maintenance downtime from blade changing is greatly reduced. Pacific Hydraulic is the safest shear. The ram, controlled by a portable foot pedal, can be stopped instantly at any point throughout the stroke in an emergency. Pacific Hydraulic cannot be damaged by overload. Independent time studies confirm that it will equal or out-produce any mechanical shear.

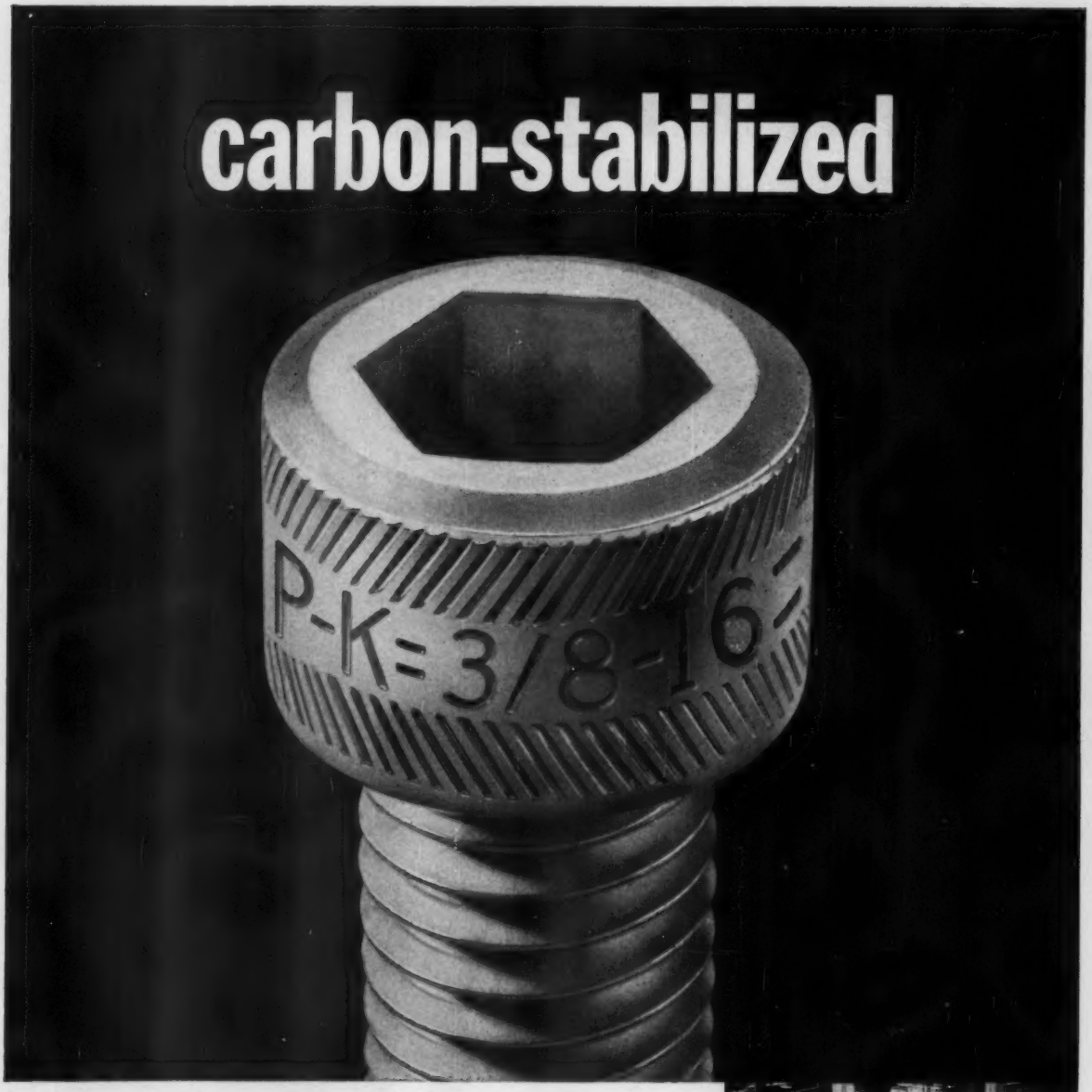
PACIFIC HYDRAULIC SHEAR

Mfg. by
PACIFIC INDUSTRIAL MFG. CO.
848 49th Ave., Oakland, Calif.
Plants: Oakland, Calif. and Mt. Carmel, Ill.

DISTRIBUTORS:

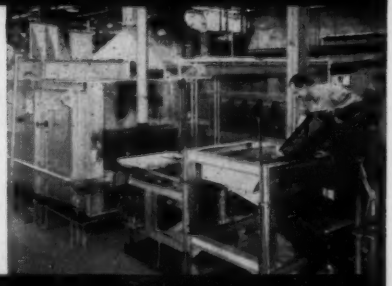
LOS ANGELES—Tornquist Machinery Co. • PORTLAND—Portland Machinery Co. • SEATTLE—Buckner Weatherby Co. • SALT LAKE CITY—Todd Machinery Co. • DENVER—Richard Ives & Co. • HOUSTON—Butcher, Carter & Preston Co. • DALLAS—Machine Tool Associates • TULSA—Martin Machinery Co. • KANSAS CITY, DES MOINES & ST. LOUIS—Moehlenpah Engr. Co. • NEW ORLEANS—Dixie Mill Supply Co. • ATLANTA—Allison Machinery Co. • NORFOLK—Tidewater Supply Co. • PHILADELPHIA, BALTIMORE—Caico Machinery Co. • NEWARK— G. M. Pearse & Co. • PITTSBURGH—Steel City Tool & Machinery Co. • BOSTON—Wigglesworth Machinery Co. • ROCHESTER—Macaulay Machinery Co. • CLEVELAND—Wigglesworth Machinery Distributors • INDIANA—Harry B. Green Machinery Co. • CHICAGO, MILWAUKEE—The Guto Co. DETROIT—Taylor-Thompson Machinery Co. • MINNEAPOLIS—Satterlee Corp. • LOUISVILLE—Harry B. Green Machinery Co. • ALBUQUERQUE—Richard Ives & Co. • CANADA—Williams & Wilson Ltd.

carbon-stabilized



PARKER-KALON stress relieved socket screws

All P-K® Socket Screws are hardened in a propane atmosphere in this Westinghouse furnace to prevent carbon loss, eliminate adsorption of foreign gases. Part of P-K's controlled processing which assures consistent high quality, prevents precipitation or crystallization. Another good reason why . . . *If it's P-K . . . It's O-K!*



PARKER-KALON DIVISION, General American Transportation Corporation • Manufacturers of Socket Screws, Self-tapping Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws.

Sold Everywhere Through Leading Industrial Distributors — Factory, Clifton, New Jersey • Warehouses, Chicago, Illinois, Los Angeles, California

PARKER-KALON® fasteners

CLEEREMAN

"Series A" *Automatic* Drilling and Tapping Machines

producing faster... better... easier... from coast to coast!

Hartford, Conn.
Pratt & Whitney Aircraft

Midland Park, N. J.
Marlow Pumps Division

Reading, Pa.
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Syracuse, N. Y.
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Barberton, Ohio
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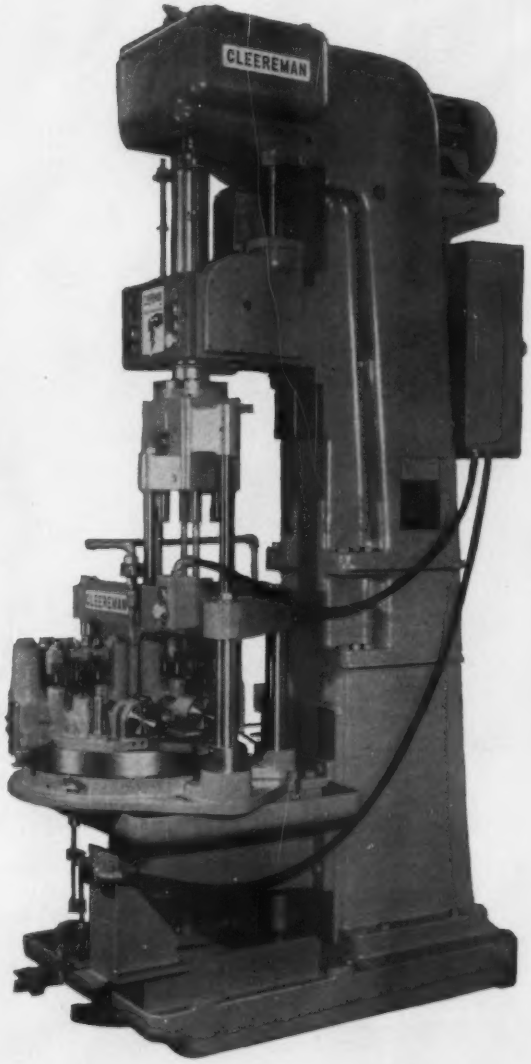
San Francisco, Calif.
Chas. M. Bailey Co.

South San Francisco, Calif.
Smith-Blair Co.



These are a few of the Cleereman "Series A" users who find this "box cycle" automatic Drilling and Tapping Machine the answer to their problems.

Drilling and tapping a hole "at the touch of a button" produces faster, easier and at highest profits. Operators are relieved of handling cumbersome controls. Operator morale is boosted and operator fatigue reduced.

Join the rapidly increasing Cleereman "Series A" users list. This fast set-up production-type drilling and tapping machine has a place in your plant. Don't delay increasing your production efficiency. *Wire, write* or *phone* about your jobs right now.

BRYANT
Machinery & Engineering • Company •
General Office
555 West Washington Blvd., Chicago 6
Representatives in Principal Cities

CLEEREMAN MACHINE TOOL CORP.
GREEN BAY, WISCONSIN

Charlie Middleman, Foreman, says:

"I LIKE GEOMETRIC DIE HEADS because . . .

. . . there is practically no down time for changing chasers. Our chasers are resharpened in the tool conditioning department so we always have sharp sets handy. Joe here has just finished a new setup. He took out the old chasers, snapped in a new set and adjusted them to size on a sample work piece in 2 minutes flat!

Supermetric chasers? We like them fine. We get lots more pieces and better threads with them."

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC

Photo courtesy of the Barber-Colman Company

THE LATHE — *Hendey No. 2E 14" General Purpose Lathe*

THE OPERATION — *Turning and facing an aluminum component*

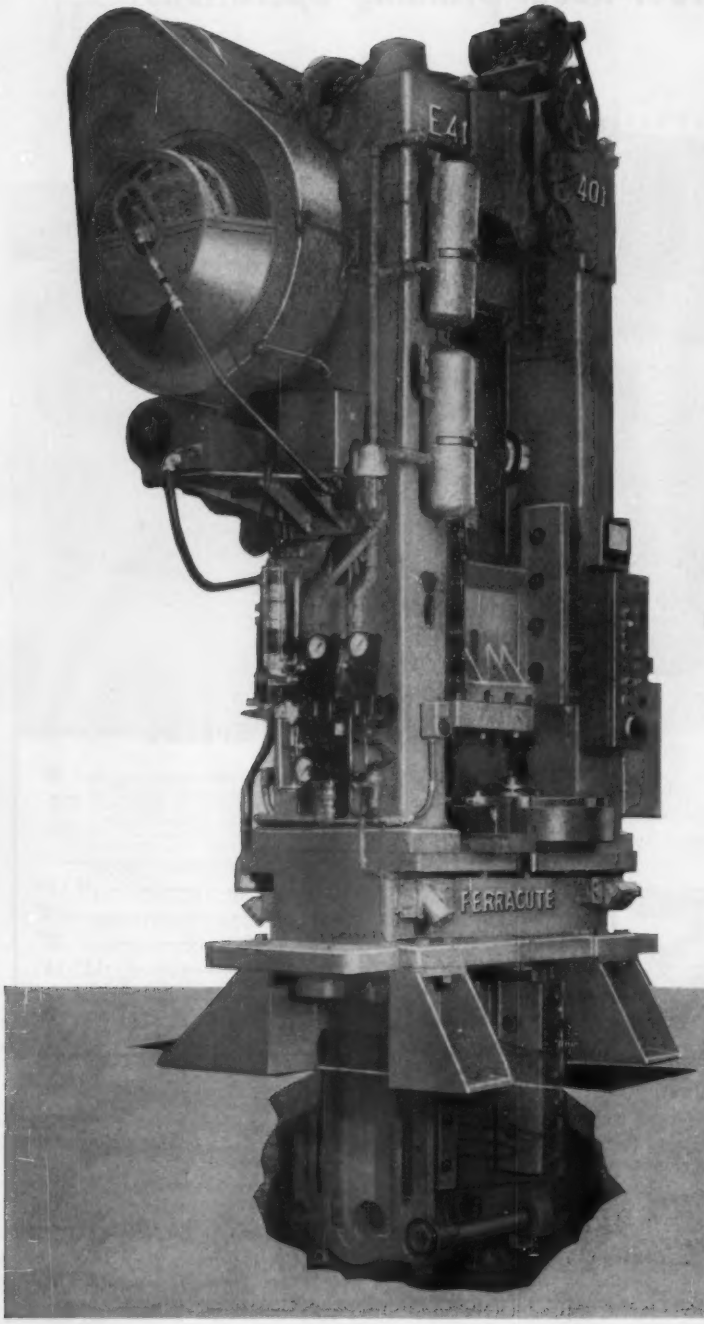
THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

HORTON
Since 1851
CHUCK

Call Your Horton Distributor Now!

A NEW FERRACUTE PRESS



TO SIZE OR "RESTRIKE" POWDERED METAL PARTS

400-ton SPECIAL
DOUBLE TOGGLE COINING PRESS
with 100-ton pressure on lower knockout

Stroke: Upper toggle—9"
Stroke: Lower knockout—1" to 3½"
Variable Speed Drive: 15 to 30 S.P.M.
Feeding Mechanism: Cam-operated dial

Your inquiries invited on the efficient press production of powdered metal components. Press sizes and tonnage capacities available to meet your requirements

Since 1863

FERRACUTE

FERRACUTE MACHINE COMPANY
Builders of Power Presses and Special Machinery
Bridgeton, New Jersey, U.S.A.

Call Your Norton Distributor Now!

SWISS **REISHAUER** MADE

UNIVERSAL THREAD and WORM GRINDERS

For Production or Tool Room Grinding Operations

The Type NRK UNIVERSAL Thread and Worm Grinder is designed for grinding with single or multi-thread wheels. This machine, with attachments, can be used for grinding and relief-grinding of external—right- and left-hand—single or multiple screw threads—to any desired profile.

THE NRK GRINDS:

- **Thread Gauges**
- **Taps — all kinds — straight or spiral flutes**
- **Thread Milling Cutters**
- **Trapezoidal Thread Spindles**
- **Thread Chaser Dies for self-opening die heads**
- **Gear and Worm Hobs**
- **Cylindrical Press Rollers**
- **Thread Rolling Dies up to 8" diameter**
- **Crushers for forming multi-rip grinding wheels**
- **Commercial Threads — plunge cut method — on all kinds of screws, studs, spindles, etc.**
- **Internal Threads up to 5" diameter**
- **Racks up to 18" long**

CAPACITY AND SPEEDS

Admits work pieces between centers	28"
Maximum length of thread ground	17-½"
Minimum thread diameter	.120"
Maximum thread diameter	8"
Minimum pitch	60 t.p.i.
Maximum pitch	3"
Width of single thread grinding wheel	.32"
Widths of multi-thread grinding wheel	.8" - 1.2" - 1.6"
Speeds of grinding wheel	1550 or 1900 r.p.m.
Speeds of work spindle	1.6 to 80 r.p.m.

SEE THESE MACHINES IN OPERATION AT COSA'S NEW YORK SHOW ROOM OR SEND FOR DESCRIPTIVE LITERATURE.

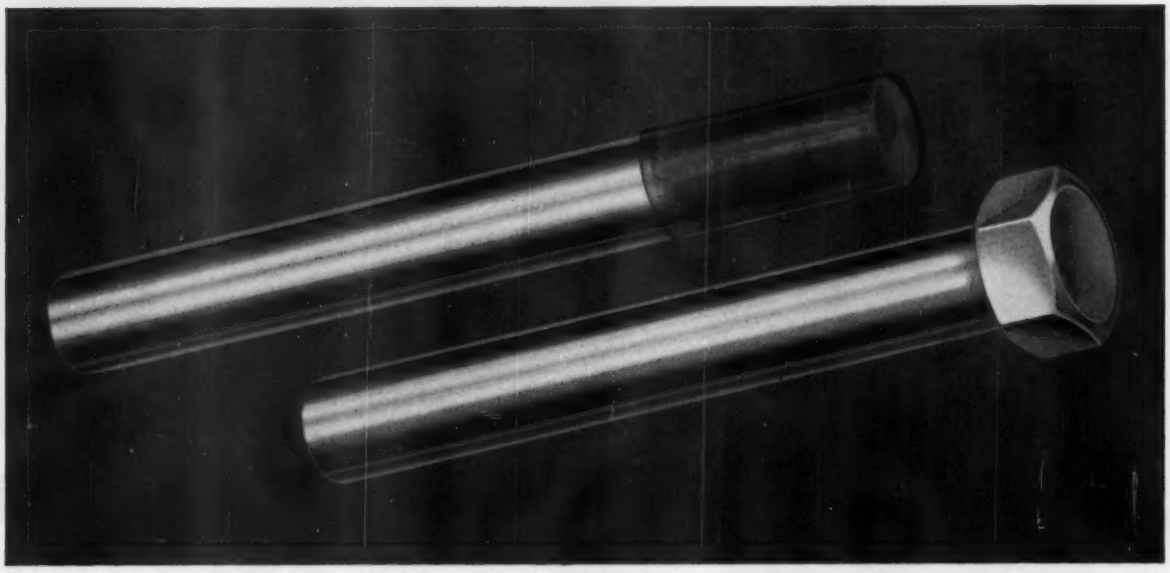
COSA — *nationwide sales and service of precision machine tools — from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

FORGING: COPPER • BRONZE • ALUMINUM • MONEL AND STAINLESS STEEL

Die Life Increased Up To 400%

with TOCCO* *Induction Heating*



● Naval Bronze, Silicon Bronze, Copper, Aluminum, Monel and all types of stainless steel are heated for forging at the H. M. Harper Co., Morton Grove, Illinois. Regardless of material TOCCO can be profitably applied to brazing, heat-treating and forging operations in almost any metal-working plant.

Production Up—In addition to the very important savings in forging dies, TOCCO has increased production to as much as 265% of output possible with former heating methods. On the 1" type 303 Stainless machine bolt blanks shown here TOCCO upped production from 75 to 200 parts per hour, using 35 K. W., 10,000 cycles.

Versatile—The same TOCCO machine is used on stock of ⅜" to 1¼" diameter; heated zones vary from ½" to 4". TOCCO'S automatic timing cycles provide complete uniformity of heating throughout both length and cross section—assuring a uniformly high quality product.

Why not have a TOCCO Engineer investigate your plant to determine where TOCCO can cut your costs and streamline your production?

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—**NEW FREE Bulletin**

The Ohio Crankshaft Co. • Dept: B-3, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Heating for Forming and Forging".

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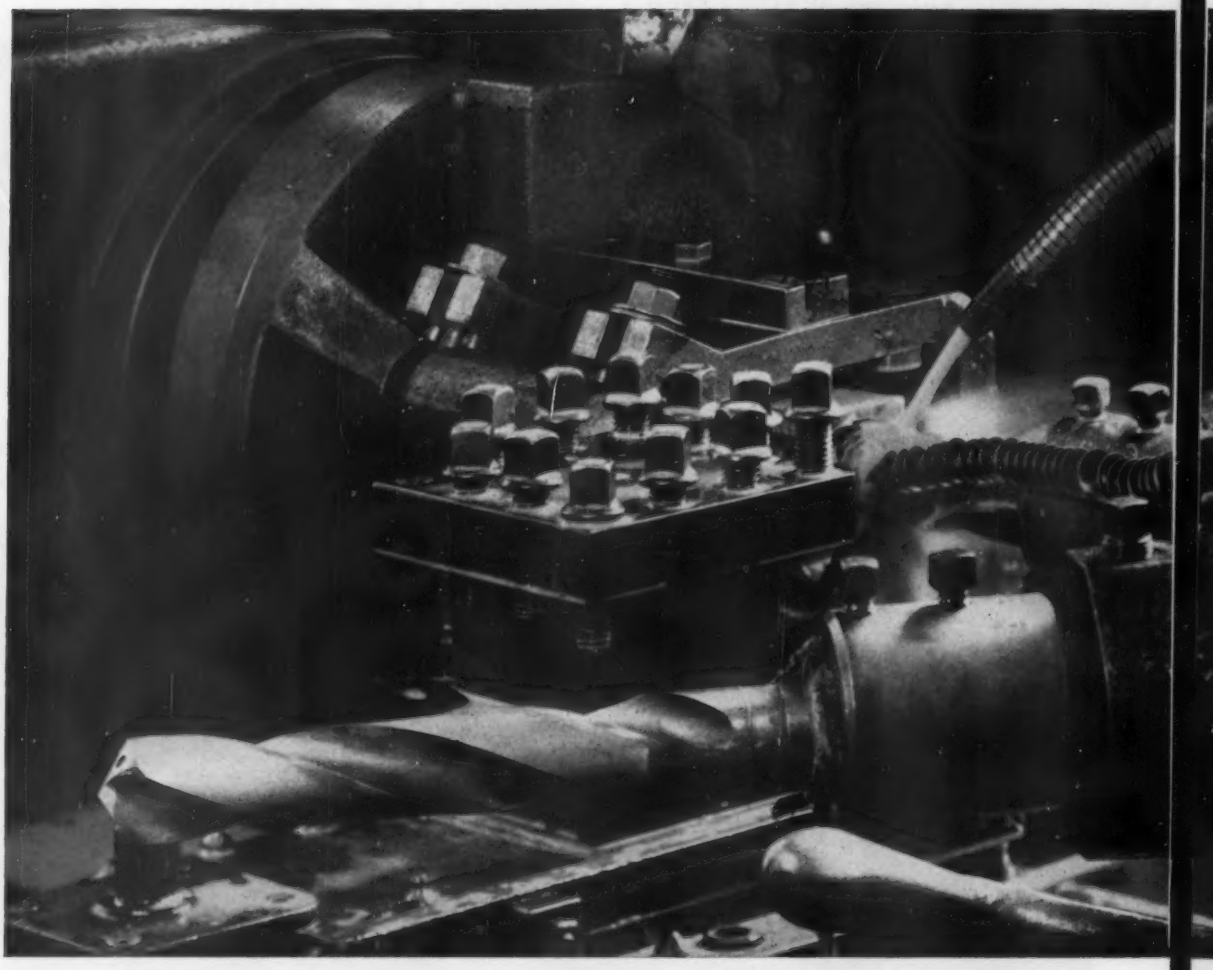
Position_____

Company_____

Address_____

City_____ Zone____ State_____



Only One Man Knew This

It was one of the many thousand machines that today share the same fate... on the way to wearing out without ever once running at

TOP SPEED!

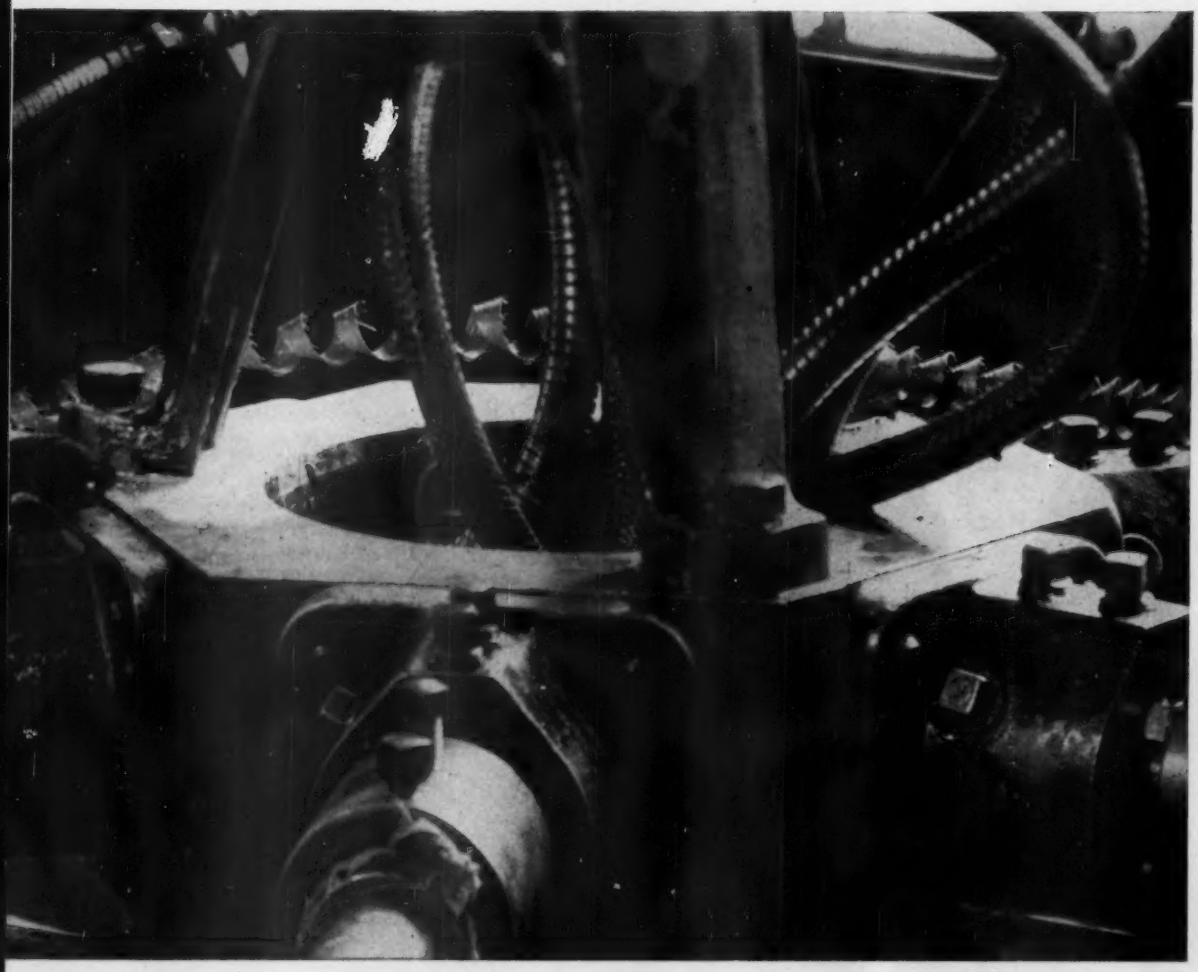
Everyone thought its production was satisfactory. But then someone in the front office decided to try ANTISEP.

The Houghton Man was called in. He looked the old lathe over, then prescribed a test run with ANTISEP Cutting Base. When he suggested the speeds and feeds to go with ANTISEP, everybody thought he was kidding. Either that, or he was out to break the old girl up.

This lathe is running, right now, at higher speeds than it ever ran with oil-base cutting fluids. Feed has been increased. It's producing more than it ever did before—thanks to ANTISEP.

The super-cooling power and extraordinary lubricity of ANTISEP make it possible. Mixed 1:25 with water, ANTISEP cools as no oil can. Other benefits: no smoke, no rancidity, no chip buildup. Finish quality is limited only by the capabilities of machine and tool.

Best of all, ANTISEP is just one of a whole family of superior Houghton cutting oils and bases. Ask your Houghton Man about them today.



Lathe Could Cut So Fast

HOUGHTON'S FAMILY OF CUTTING OILS AND BASES:

Cut-Max	Series of fortified ready-to-use cutting oils and concentrated bases for dilution by user.
Antisep All-Purpose Base	Miscible with either water or oil; for 90% of all machining uses.
Antisep Soluble Oil	Antiseptically treated; detergent action; releases grinding dust.
Houghto-Grind 50	Grinding concentrate; stops rust, won't load wheel.
M. M. Honing Oil	Beats kerosene for honing.

ANTISEP BASE

...a product of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

They cut out three oils by changing to one...

Standard Oil lubrication specialist Bob Cleland and plant manager I. G. Smallegan inspect work furnished by operator Dick Stockwell. Giving technical help to customers like this is something for which Bob Cleland is well fitted. Bob has a mechanical engineering degree from Michigan State and has completed the Standard Oil Sales Engineering School.

STANICUT Oil 166 BC

Screw machine plant saves on oil inventory and handling, receives other benefits by converting to dual-purpose cutting oil.

Grand Rapids Metal Products Company's problem was the mixing of cutting and lubricating oils in their National Acme and Gridley screw machines. In all, four oils were used. In some machines a cutting oil, two lubricating oils and a base oil were employed to improve machining characteristics. Lubricating oil leaking past seals mixed with the cutting oil, reducing cutting oil qualities. Oil mixtures were constantly varying, and troubles in tapping resulted.

Standard Oil's Bob Cleland, working with plant management, suggested STANICUT Oil 166 BC. This oil, he explained, is a dual-purpose oil. It can be used for lubrication as well as for cutting, and no dilution of the cutting oil can occur.

After a week's trial in one machine, the entire plant was converted to STANICUT Oil 166 BC. Tap troubles were reduced, resulting in much less down time. Spindle speeds have been increased, yet the spindles run cool. Oil inventories have been reduced from four to one.

STANICUT Oil 166 BC does not corrode bearings, gears, bushings, spindles or other machine parts. While STANICUT Oil 166 BC contains E.P. additives, it does not stain copper or brass.

Get the facts on how STANICUT Oil 166 BC can help you. Call the Standard Oil office nearest you anywhere in 15 Midwest and Rocky Mountain states. Or write to Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Quick facts about
STANICUT OIL 166 BC

1	A dual-purpose oil — suitable for both cutting and lubrication.
2	Non-corrosive to work or machines.
3	Formulated with E.P. additives.
4	Stable under all normal conditions.
5	Non-irritating.
6	A cutting oil that permits high operating speeds.
7	Non-staining to either copper or brass.

STANDARD

STANDARD OIL COMPANY
(Indiana)

If WEAR *is a factor...*

...use VK CARBIDE PLUG GAGES

TUNGSTEN CARBIDE
wire type .010" to .760" diameter*

TUNGSTEN CARBIDE
taper lock type .365" to 1.510" diameter

In addition to its regular line of tungsten carbide wire type plug gages from .010" to .760" diameter, The Van Keuren Co. now offers a line of tungsten carbide taper lock plug gages in the range from .365" to 1.510" diameter.

Van Keuren tungsten carbide wire type gages have proved their worth on thousands of tough gaging jobs. VK tungsten carbide taper lock gages are similarly effective. If wear is a factor in your overall gage costs, you can save money by using VK carbide plug gages.

Finish on VK gages in either the wire type or taper lock type in tungsten carbide will average .5 RMS or better.

These gages are available in Class Y, X, XX and XXX accuracies at moderate prices and on a reasonable delivery basis.

*Note full length wire-type member in above illustration.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

VK

38th YEAR

THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

WHY PAY MORE for specials, when you can get what you need FROM STOCK?

Design around
BOSTON Gear
100 SERIES
SPEED REDUCERS
1605
types and ratios
FROM STOCK

Horizontal Right Angle Drive
Worm Gear over

Horizontal Right Angle Drive
Worm Gear under

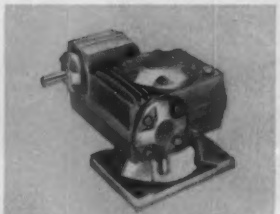
REDUCTORS Ratios 1:1 to 3600:1 — .004 to 50 HP

Vertical Right
Angle Drive

FROM STOCK!

Double Reduction
Horizontal Parallel Drive

Horizontal Right
Angle Drive



Double Reduction
Vertical Right Angle Drive

Horizontal Right
Angle Drive

Double Reduction
Horizontal Parallel Drive

RATIOMOTORS Output RPM .49 to 175

Vertical Right
Angle Drive

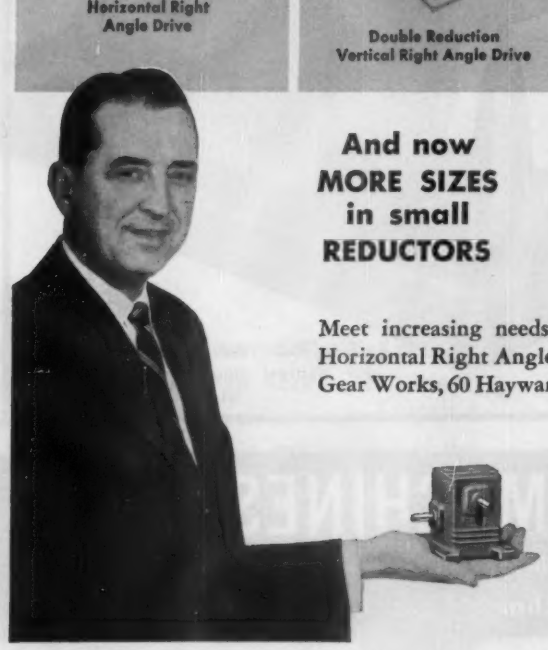
FROM STOCK!

Double Reduction
Vertical Right Angle Drive

All Ratiomotors also sold without motors as
FLANGED REDUCTORS

FROM STOCK!

You buy and attach your choice of motor



And now MORE SIZES in small REDUCTORS

Meet increasing needs for smaller units in Horizontal Right Angle Drive models. Boston Gear Works, 60 Hayward St., Quincy 71, Mass.

Catalog No. 56
lists full specifications, includes 50 pages of engineering data to aid in selection and application.

CALL YOUR BOSTON Gear DISTRIBUTOR

For nearest Distributor, look under "GEARS" in the Yellow Pages of your Telephone Book

57BG-RR-31

The Bridgeport TURRET MILLING MACHINE

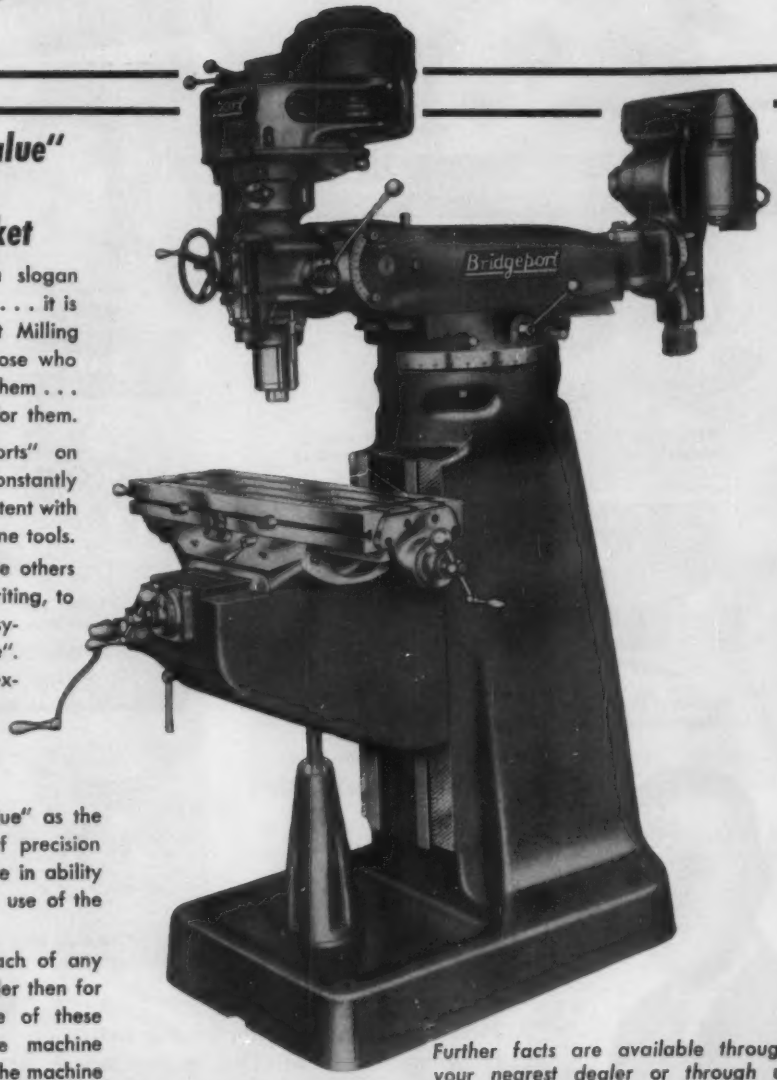
. . . the "greatest value" in the machine tool market

The "greatest value" is not a slogan coined here in Bridgeport by us . . . it is the term applied to Bridgeport Milling Machines universally . . . by those who use them . . . by those who sell them . . . and by those who are waiting for them.

To those who have "Bridgeports" on order, may we say that we are constantly stepping up our production consistent with turning out highest quality machine tools.

It is most gratifying to us to have others go on record, verbally and in writing, to the effect that "Briageport" is synonymous with "greatest value". And it is no accident that this expression should be so universally applied to Bridgeport Millers. Everything connected with the design and building of these machines has had "value" as the objective . . . value in terms of precision . . . value in versatility . . . value in ability to get maximum utility from the use of the "Bridgeport".

"Bridgeports" are within the reach of any shop, small or large. Small wonder then for the recognition and acceptance of these time-tried and proved versatile machine tools . . . the "greatest value" in the machine tool market.



Further facts are available through your nearest dealer or through us direct.

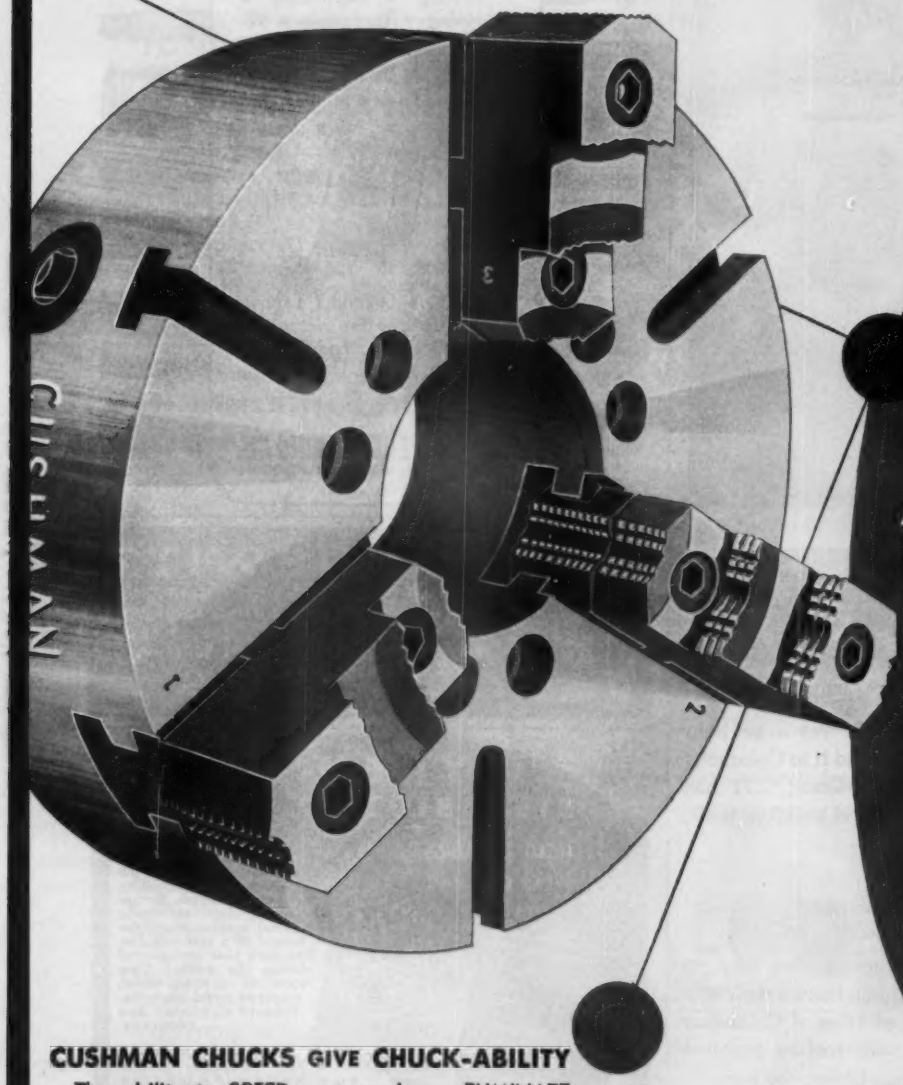
Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

CUSHMAN CHUCKS

the answer to precision workholding



MANUALLY OPERATED CHUCKS

AIR OPERATED CHUCKS

CUSHMAN POWER WRENCHES

ACCRA-SET CHUCKS

JET ENGINE CHUCKS

CUSHMAN CHUCKS GIVE CHUCK-ABILITY
—The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right workholding devices.

CUSHMAN the CHUCKMAN
CHUCKS AND ACCESSORIES Exclusively SINCE 1867

CUSHMAN CHUCKS . . .
a Product of American Quality, Labor and Materials

SOLD THROUGH YOUR INDUSTRIAL DISTRIBUTOR

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut

send it out to CDT

There is no faster, more reliable way to get help with difficult tooling problems than to send it to Columbus Die-Tool. Backed by 50 years of experience, CDT has three basic objectives when designing and building tools, jigs, fixtures or special machinery.

1. Increase Production
2. Improve Quality of Product
3. Lower Production Costs

These and other benefits are reasons why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool. Perhaps we can solve your tooling problem and help you make your product . . . better, for less.

Columbus Die-Tool
AND MACHINE COMPANY

P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

VAILL

TUBE END-FORMING MACHINES

have hundreds of tube end-forming and shaping applications . . .

Fast, accurate production at less cost.

Beading • Flaring • Flanging • Sinking • Expanding • Grooving • Threading • Reducing • Double Lap Flaring • Double Lap Flanging.

On tubing up to 6 in. diameter.

Free—New Bulletin T-1 shows and describes the versatility of Vaill Tube End-Forming Machines.

THE VAILL ENGINEERING CO.
135 E. MAIN ST., WATERBURY 20, CONN.

TANNEWITZ

VARIABLE SPEED TOOL ROOM BAND SAWS AND HIGH SPEED METAL CUTTING BAND SAWS . . . SINGLE OR VARIABLE . . . 50 TO 15,000 FPM. PRODUCT OF MORE THAN 50 YEARS OF SPECIALIZATION. Write or phone.

The TANNEWITZ WORKS Grand Rapids, Michigan

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2301B North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME

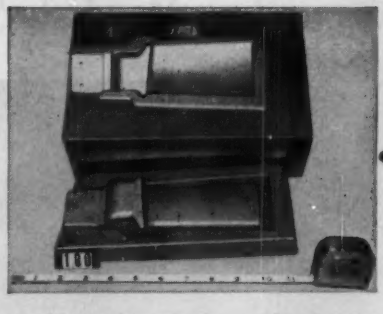
END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301B NORTH 11TH ST., ST. LOUIS 6, MO.

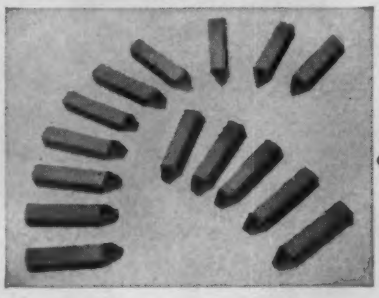
FORGING DIE

Material: Heppenstall 'A'
Conventional Machining
Time: 40 hours
Elox Setup & Machining
Time: 8 hours
Saved: 32 hours
Machine tool: Elox Standard M-500
Electrode: Cast Elo-met #3
Customers report 75% time saving in re-working dies after washout . . . no annealing is necessary.



TUNGSTEN CARBIDE SINGLE POINT TOOLS

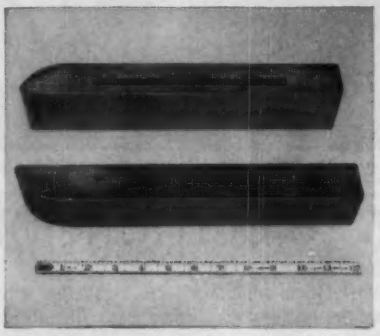
E D M produces 14 identically machined tools per hour. Times include roughing and finishing, machining both faces, nose radius and top. Radius held to ± .001". Tools were produced by 1 man operating 2 Elox Tool & Cutter Grinders, using a brass wheel. Users report Elox ground tools give greatly increased life when compared to abrasive ground tools.



EMBOSSING DIE

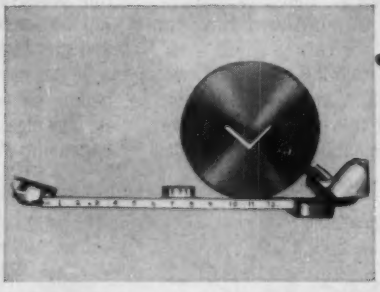
Material: Air Hardened Tool Steel
Die consists of 1,250 squares machined .100" x .030" deep in the bottom section of the die. Sharp corners on each square had to be maintained.

Conventional Machining
Time: 227 hours
Elox Setup & Machining
Time: 10 hours
Saved: 217 hours
Machine Tool: Elox Standard M-500
Electrode: Free machining brass



EXTRUSION DIE

Material: Air Hardened Tool Steel
Conventional
Machining Time: 4 hours
Elox Setup &
Machining Time: 1 hr. 38 min.
Saved: 2 Hrs. 22 min.
Machine Tool: Elox Standard M-500
Electrode: Free machining brass
Machining is done after final heat treating . . . eliminating the possibility of distortion.



FROM THE HEART OF EDM

. . . 4 jobs that prove Elox puts you ahead of competition

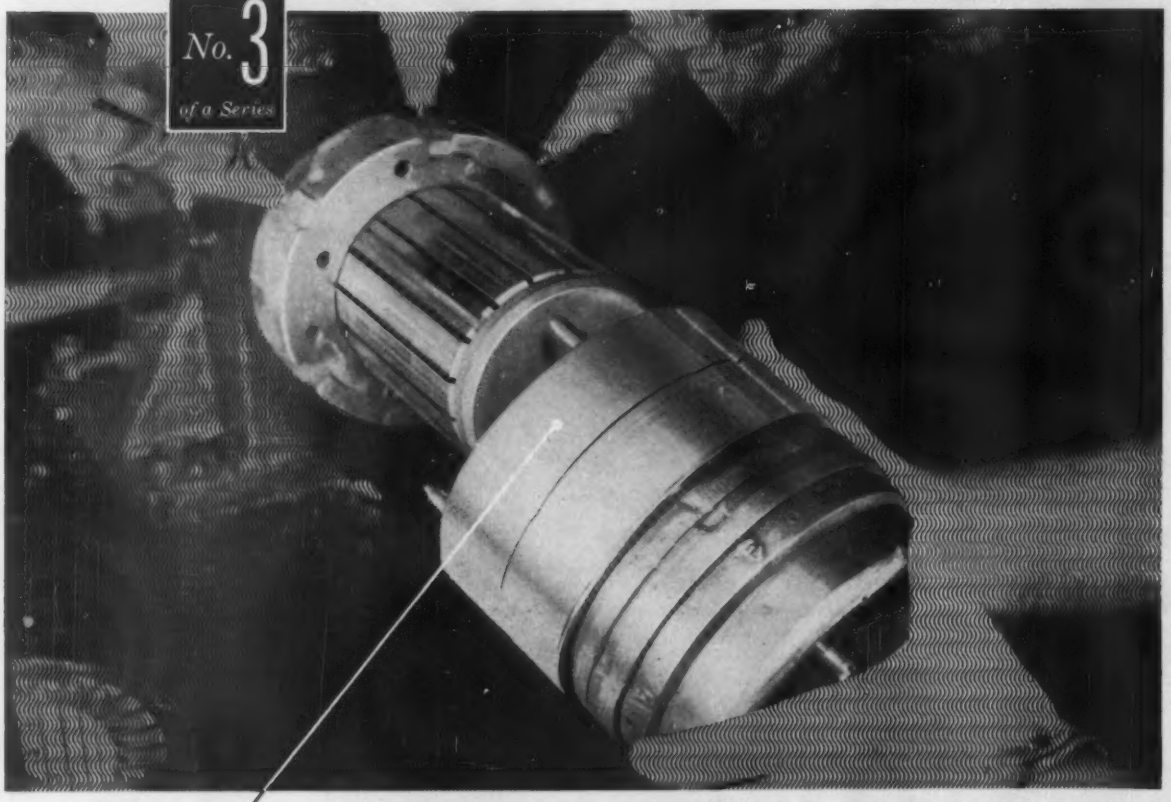
These jobs were done for Elox customers in our "Prove It" Division. There's more to them than just "man hours" saved. The Elox sales engineer in your area would like to give you all the details about these and other applications of Electrical Discharge Machining. Why not write . . .

elox *corporation of michigan* ®T. M. Reg.

1828 N. Stephenson Highway
Royal Oak 3, Michigan

Erickson Precision Expanding Mandrels Solve Assembly Problems

No. 3 of a Series



Photos: Courtesy The Emerson Electric Mfg. Co., St. Louis

e.g. electric motor stators

Emerson Electric, big-name electrical manufacturer, assembles stator laminations the modern way—with Erickson Mandrels. Gone are the old-fashioned arbor assembly methods that require a large tolerance between laminations and arbor . . . that lead to eccentricity of stator bore and to additional finishing operations on the OD.

Emerson Electric works "from the inside out" with Erickson Precision Expanding Mandrels. Laminations are placed on a fixture and the fixture slipped over the expanding mandrel. Laminations are then welded together with two passes through a three-torch head.

Result? Stators are concentric within Erickson's guaranteed accuracy of five "tenths." And Emerson Electric gets a better motor with uniform air gap . . . that produces uniform torque and rated horsepower . . . that creates minimum electrical interference . . . and that lasts longer.

If this cost-cutting case history triggers your imagination, contact the nearest Erickson representative. He'll be pleased to demonstrate how Erickson Precision Expanding Mandrels can cut your assembly costs.

AA-4133

Collet Chucks
Floating Holders
Tap Chucks
Indexers

ERICKSON TOOL COMPANY

2309-3 Hamilton Avenue • Cleveland 14, Ohio

Tap Holders
Air-Operated Chucks
Expanding Collets
Special Holding Fixtures

Bothered by a tough holding problem? Then let us show you how Erickson mandrels speed production, lower grinding or inspection costs. Write for Catalog K.

ID of stator assembly (lower left) requires no finishing operation after welding.

"TRUKUT® increased production 4 times..."

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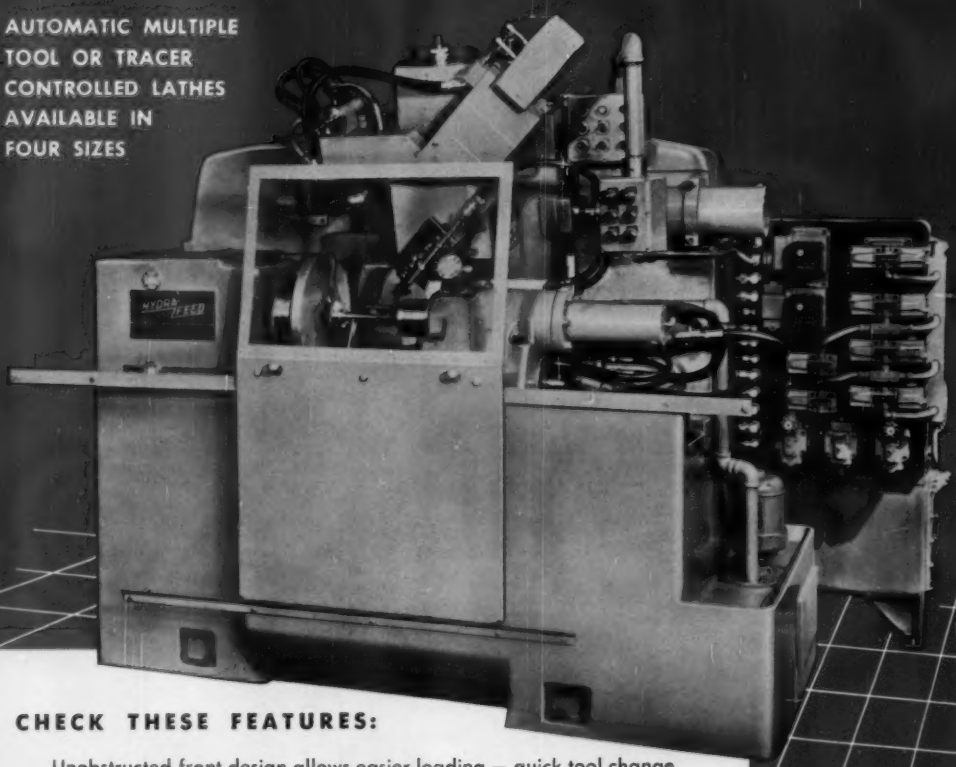

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New York—Four out of five American Machinist subscribers surveyed recently find the "Nuggets" in the annual Production Planbook and Buyers' Guide Issues "useful"; almost 90% retain copies from year-to-year for future reference in helping solve production problems.

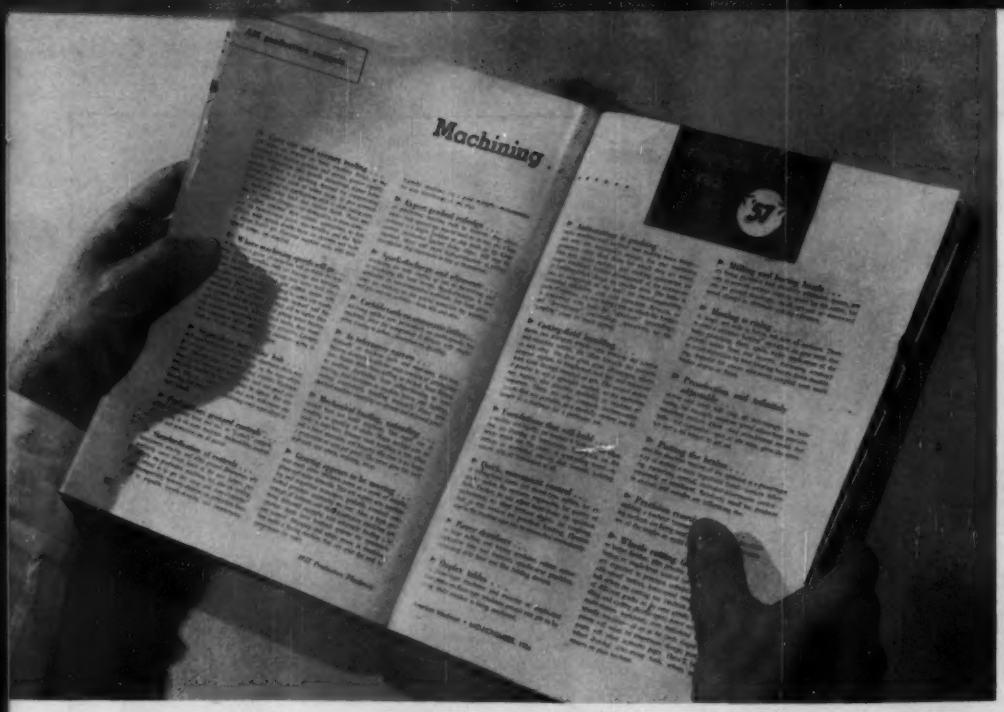
If you have a tough machining problem, for example, turn to Section B in your copy of the 1957 issue. Here you will find 27 pages of core ideas on successful machining processes reported in the regular issues of American Machinist for a full year.

American Machinist issue dates and page numbers in which the original materal was published are included, if you wish to refer to the full text. In many instances the drawings, diagrams or photos are re-published in the Planbook issue.

Other Idea Values

For a check-list of machining things-to-come, see pages B-28 and B-29, "Developments to Watch in '57." Here is a summary of important machining developments sure to spark ideas for improved machining processes.

Added values are the "Manufacturers' Free Literature" lists starting on page B-26; and "Names in the Nug-



gets," page B-154, which furnishes the trade or manufacturers' names of equipment described in the "Nuggets."

Buyers' Guide Lists Sources

Section J, a complete Buyers' Guide of sources-of-supply for machine tools, other production equipment, parts, components and supplies, enables you to take immediate action on ideas generated by the "Nuggets," through direct contact with vendors who are listed in the Buyers' Guide. The names of advertisers in the Planbook are shown in bold-face type, with page numbers of their advertisements, to help you get product information right away.

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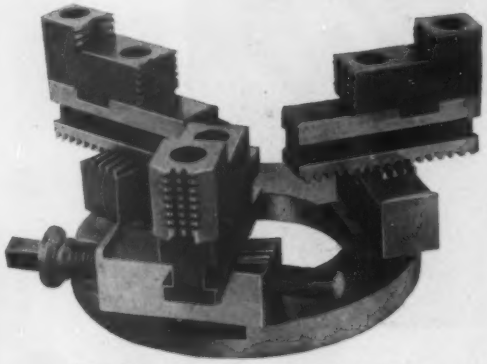

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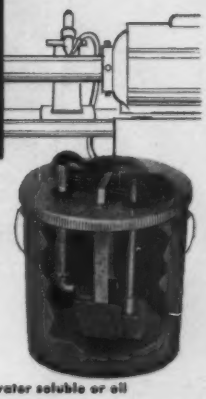

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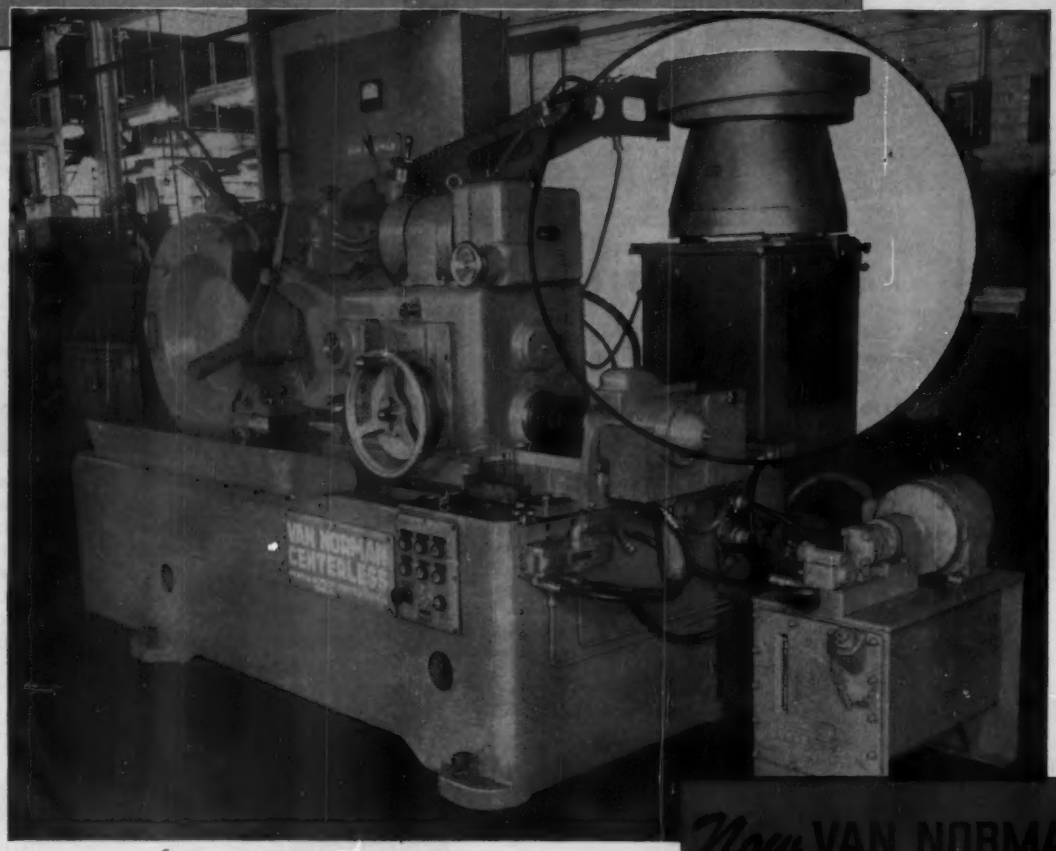

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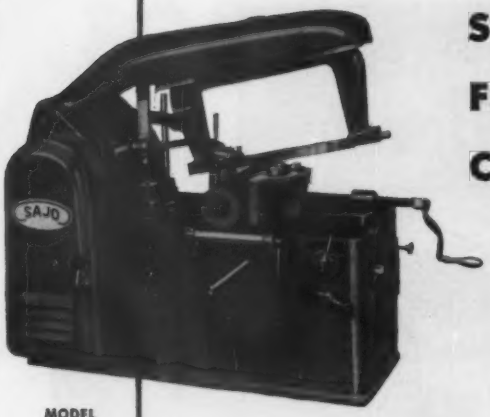

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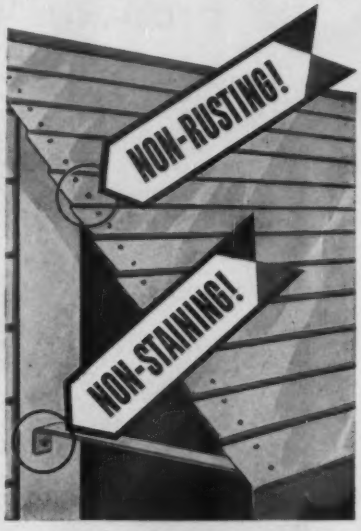

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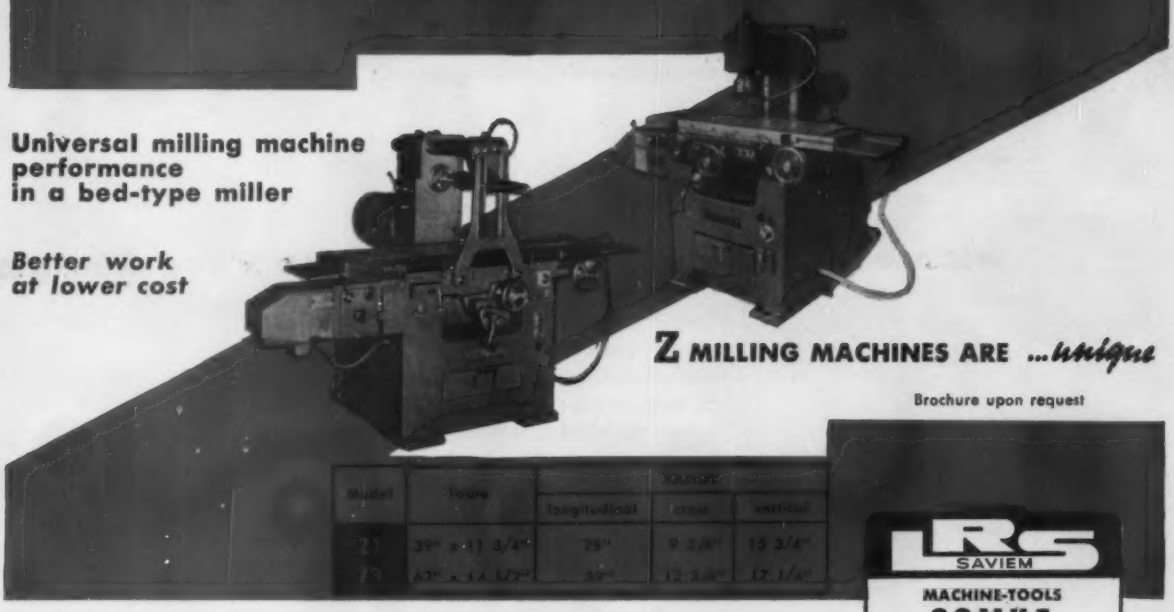

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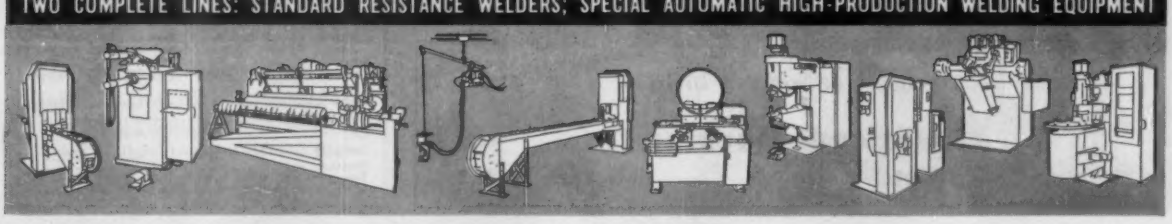

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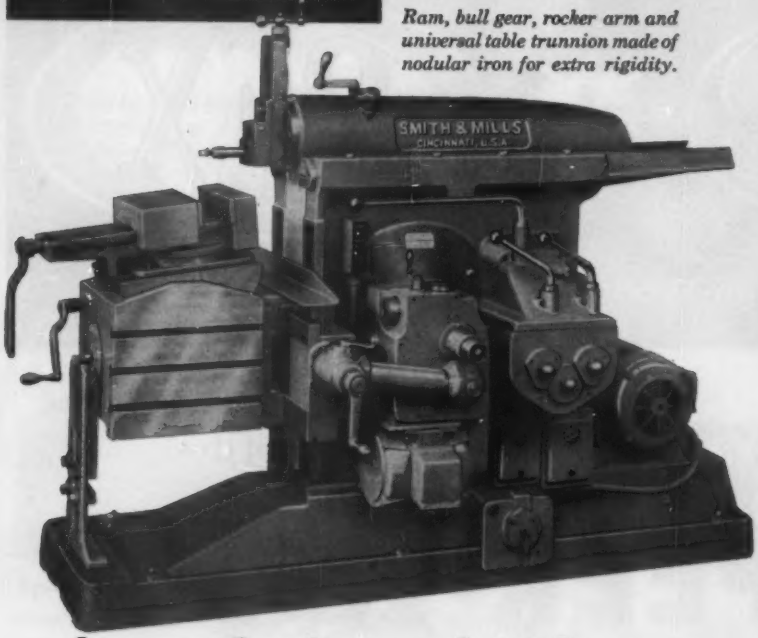

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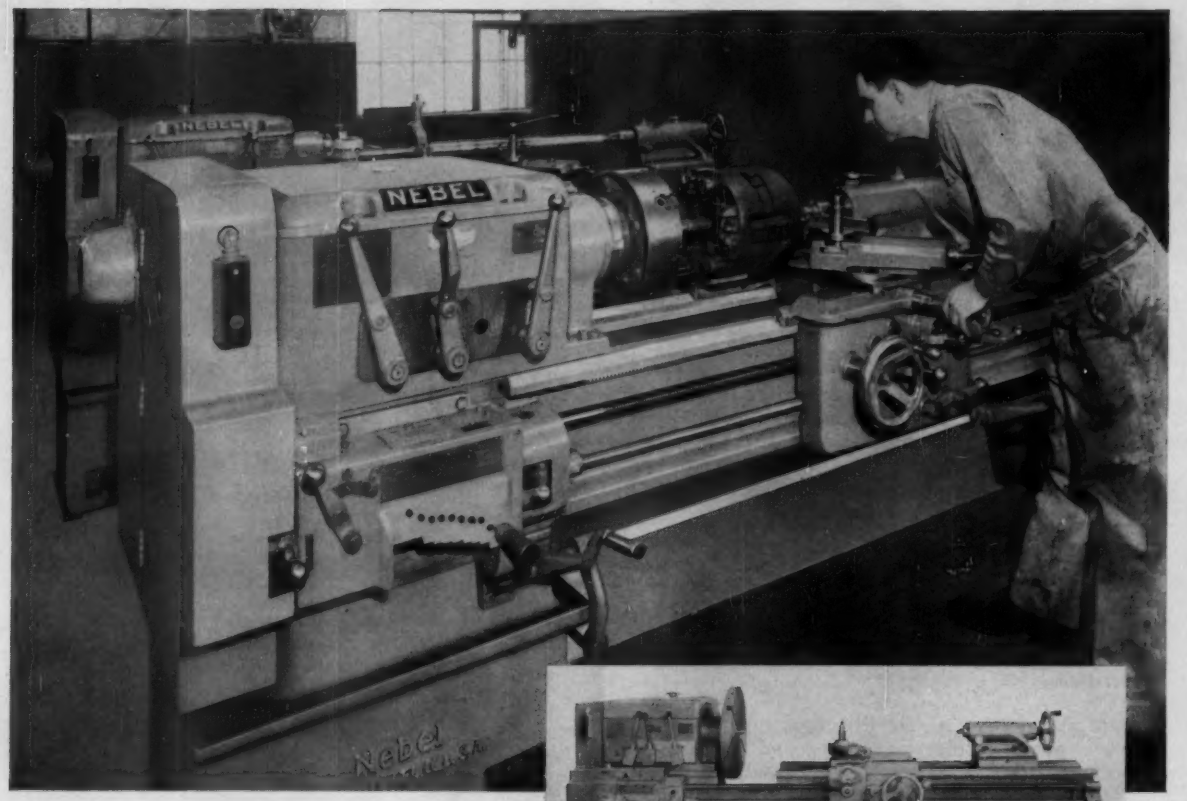

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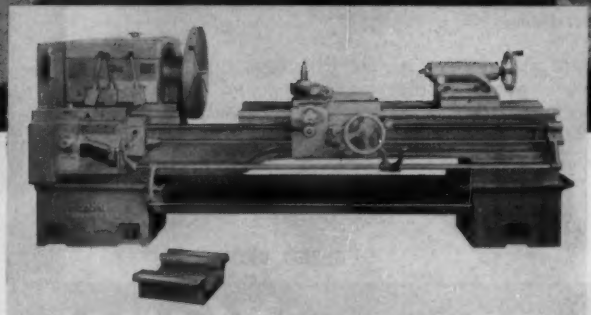


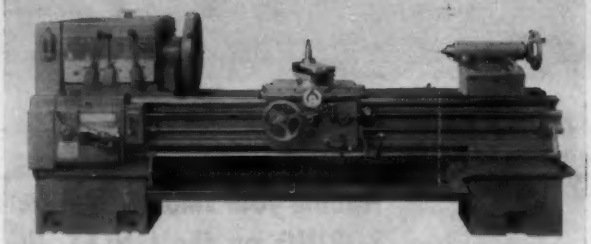
"this Nebel pair reduced machining time 1/3"

Fred R. Emberger, Plant Engineer, Continental Can Co. Shellmar-Betner Division, Devon, Pa.

"Our two Nebel Lathes—LA 20″/30″ removable block gap and LA 20″ standard—have reduced lathe machining time by 33⅓ percent. They have eliminated the need for carrying a big inventory of spare parts. These Nebel lathes give more power and stability, and insure greater accuracy than we could obtain with conventional lathes."

Mr. Emberger states further: "In our shop the most important maintenance equipment is the lathe. That's why we chose Nebel."

This confidence is reflected wherever you find Nebel lathes—and that's wherever accurate, economical maintenance and production turning facilities are required. For further information, write for descriptive bulletins. Nebel Lathe Division, Nebel Machine Tool Corp., 3407-A Central Parkway, Cincinnati 25, Ohio.



Standard lathes Six sizes: 16″ and 20″ (above); also 25″, 27″, 32″ and 36″. Nebel also manufactures extension bed gap lathes: AG 20″/40″ medium duty, G 28″/50″ heavy duty and XB 20″/40″ heavy duty.

New LA Bulletin describing the gap and standard lathes mentioned above. Send for your free copy today.

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The *real* criterion for reduction units is unfailing performance over the years, with minimum maintenance. Our files show many cases where Grant Reducers are still providing every-day service, after two decades, without a breakdown.

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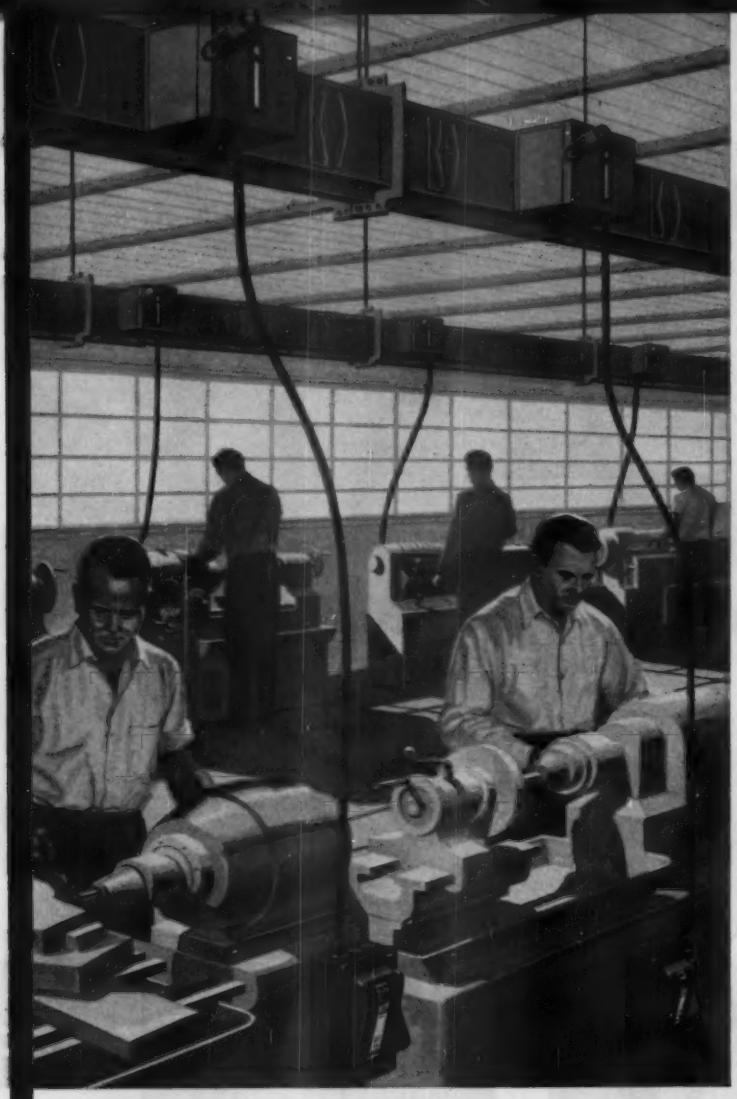
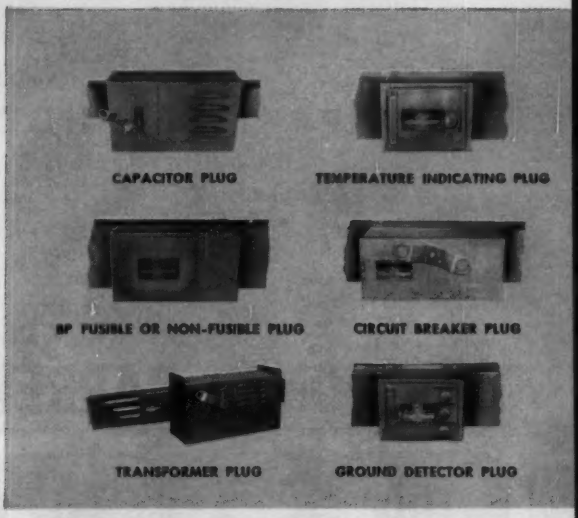


The Vacu-Break® Plug (above) taps live power, is available in 30 to 600 amps, 2 or 3 pole, 600 volts or less. Reinforced fingers on all plugs insure positive pressure contact.



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Seven rugged Bus Plugs provide flexible plug-in power

Get the most from your power with BullDog Bus Plugs. Used with Plug-in Duct, the seven bus plugs range from safety-check plugs to types that tap power instantly from the duct . . . provide safe, flexible electrical distribution.

Plug-in openings are spaced every 10 inches along the duct. Handy to any machine, they reduce long costly branch-circuit runs. You simply plug in circuits where you need them . . . relocate or add machines without cutting off power, without interrupting production.

Learn how a co-ordinated BullDog distribution system, from bus plugs to unit substations, provides efficiency and flexibility that mean economical expansion. See your electrical contractor or BullDog field engineer for complete details. © BEPCO

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THOROUGHLY CLEANS EVEN THE MOST TROUBLESOME PARTS

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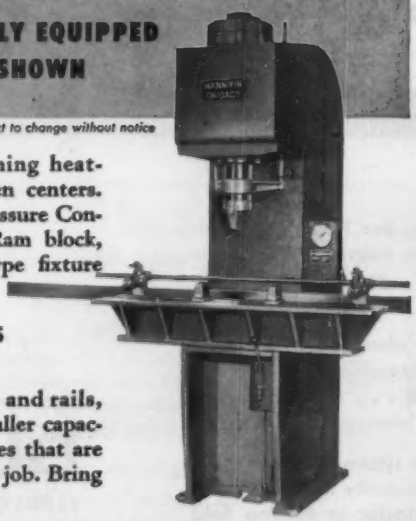
This 25-TON Hannifin Straightening Press Sells For

$4,455 FULLY EQUIPPED AS SHOWN

Price F.O.B. our press plant at St. Marys, Ohio, subject to change without notice



The ideal press for straightening heat-treated parts up to 60" between centers. Exclusive Hannifin Sensitive Pressure Control for speed and accuracy. Ram block, two table blocks and center-type fixture complete with rails included.

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Hannifin offers longer tables and rails, roller-type fixtures, larger or smaller capacities (5 to 150 tons)—all at prices that are easily justified by savings on the job. Bring us your straightening problems.

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HIGH FREQUENCY *Induction* HEATING UNITS

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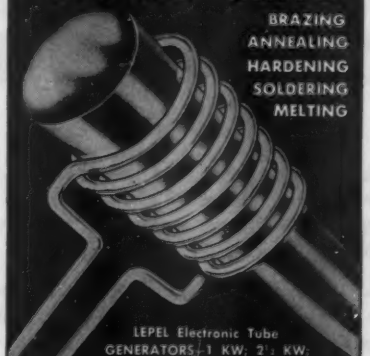

LEPEL Electronic Tube GENERATORS: 1 KW; 2½ KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
LEPEL Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

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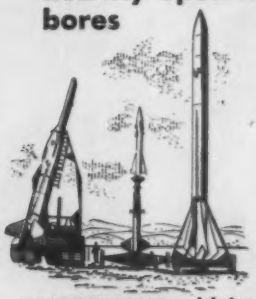
Jet Propulsion Equipment relies heavily upon this gage for critical bores



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COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from ⅛" to 10" dia.

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- Indicates actual size, a fixed — not passing — reading.
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- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
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- Reaches to bottom of blind holes.
- Will gage work in the machine.
- A shop tool for all-day every day use.
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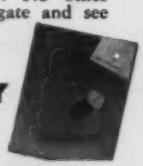
Investigate the gage used by the thousands in jet engine, guided missile, farm and road machinery, automotive transmission, household appliance and other volume-precision plants. IT MAKES PRECISION EASY . . . at machines . . . at inspection bench . . . for selective assembly. No other like it — investigate and see why.



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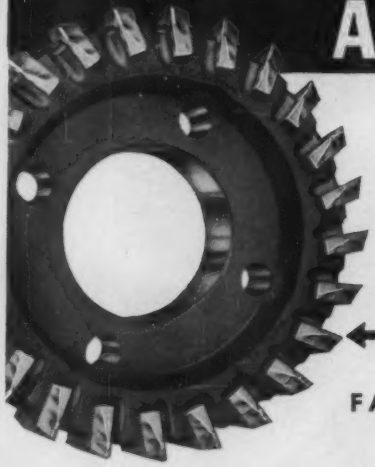
GET THE FACTS — REQUEST BULLETIN 50

PRODUCTION TOOLS BY APEX



MEDIUM DUTY FACE MILLER

This milling cutter can be had in fine tooth or heavy duty style when required. Blades are adjustable for wear. Furnished with H.S., cobalt or carbide tipped blades. Body DROP FORGED and heat treated.

Send for catalog. Service engineers will gladly co-operate with you on tooling.

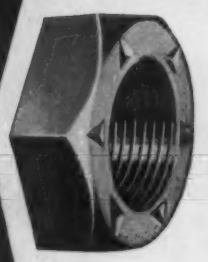
THE APEX TOOL & CUTTER CO., SHELTON 10, CONN.

Use this THIN

GRIPCO JAM NUT

FOR

- Valve Handles
- Casters
- Shears
- Clippers
- Sickle Bars



or wherever you need a positive lock on short bolts where the strength of a full nut is not needed.

GRIPCO JAM NUTS come in the New Unified Finished and Heavy Series (Hexagon), in standard full and jam dimensions, in steel, brass and aluminum.

Gripco Products Include:

Gripco Lock Nuts • New Gripco "Clinch Nuts" Gripco Hi-Nuts • Gripco Pilot-Projection and Countersunk Weld Nuts

all with or without the famous Gripco positive locking feature. Also Standard Semi-Finish Nuts.

Write for samples and full particulars.

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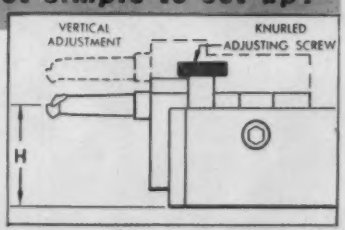
Accurate—yet simple to set up!

TOOL HOLDERS

for Bokum Boring and Threading Tools



Lathe operators can set up tools faster and more accurately with Bokum tool holders. Adjustment is simple; the only movement—straight up and down—is controlled by a knurled Acme screw. Tool is positively locked in place.

TWO SIZES

BT-0 SHANK, size ⅜" x 1" "H" adjustable from ⅛" to 1"

BT-1 SHANK, size ½" x 1¼" "H" adjustable from 1⅛" to 1⅞"

For Engine Lathes . .

Tool or bit is held under an angle of 30° with the axis of the shank in order to bypass the tool post of the lathe.

For Turret Lathes . . . . . .

Tool is held parallel to the axis of the shank. Holders, for both engine and turret lathes, available for ⅜" and ½" square tool bits.

Write for catalog 483-C

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BOKUM TOOL CO. INC. 14775 Wildemere Ave. Detroit 38, Mich.

Division of AMERICAN GAGE and MACHINE COMPANY
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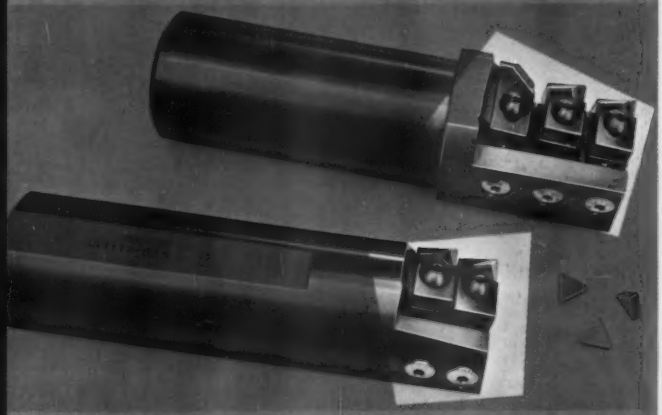
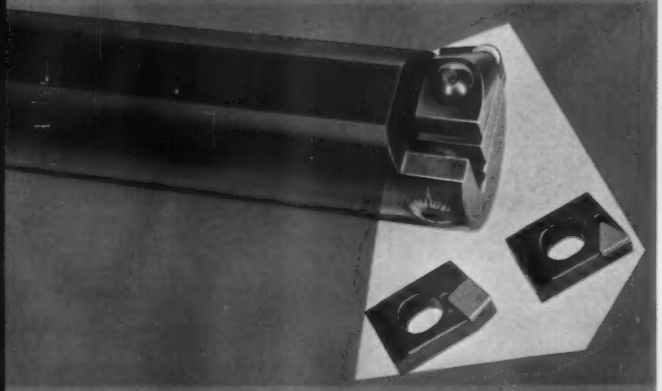
TOOL NEWS carbide

Wesson micro-adjustable tools for combined BORING AND FACING use throw-aways for both purposes.



MULTIPLE POINT micro-adjustable boring bars for multi-diameter boring and chamfering, etc., have been added to the line. Each insert is micro-adjustable and once set, stays put.



STANDARD MICRO-ADJUSTABLE boring bars are available with interchangeable anvils for different types of inserts, maximum versatility and maximum adaptability to different jobs.

WHAT THEY SAY ABOUT WESSON MICRO-ADJUSTABLE BORING TOOLS

"We've cut boring down-time for tool changes over 90% and cut tool costs from $35 to only 22 cents per 1000 pieces."

"So good, we are now using micro-adjustable boring bars in place of single point turning tools, cutting tool costs, scrap and down-time."

"Micro-adjustable boring bars with throw-aways have cut tool costs on one operation from $13,800 per year to only $1036."

Revolutionary WESSON tools uncover and cut hidden costs and scrap, improve finish

Micro-Adjustable Boring Bars With Throw-Aways Sweep Industry

Announced barely six months ago, the Wesson line of micro-adjustable boring bars designed specifically for the use of throw-away inserts has taken metalworking by storm, replacing conventional boring tools, reamers, single point tools, and multiple point boring tools in scores of applications. They are even being used for OD turning.

So general has been the acceptance and so broad the demand that the Wesson line of micro-adjustable boring tools has been expanded to a wide range of types, both standard and special. Shown here are just a few of the styles now in use in industry.

Wherever they have been applied they have shown tremendous savings in tool cost, greatly reduced machine down-time for tool changes, and minimized scrap due to boring tool adjustment. Largely contributing to this end are:

MICRO-ADJUSTMENT, an exclusive Wesson feature which provides a positive adjustment for diameter of 0.001 inch for every graduation of the screw-head dial.

ELIMINATES GRINDING of tools. THROW-AWAY inserts permit from 6 to 10 indexes to new cutting edges before discarding the insert.

LOW COST of inserts, greatly reducing outlays for consumption tooling.

(continued on page 2)

TOOL NEWS carbide

Micro-Adjustable Boring Bars

(*Continued from page 1*)

STANDARD PARTS used wherever possible to permit interchange between different boring tools, reduced inventories, etc.

CHIP CONTROL—complete with built-in adjustable chip breaker, making tools equally adaptable to long and short chip work.

LONG LIFE per tool change. In practically every case, pieces per cutting edge are higher than previous tool performance without any change in speeds, feeds or cuts.

A complete new Wesson brochure covering these boring tools has been prepared. Ask for Catalog #MB-157.

Newest No-Skill Grinder

Improved model of Wesson's Poweramic Grinder which automatically produces hone-like tool finishes at low cost in less time. It protects the tools against faulty grinding. Practically no skill is needed. Among the features responsible is Wesson's exclusive Tru-Arc grinding principle. Ask for Bulletin #PG-157.

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 18, ONTARIO

TABLE 1		
	BEFORE	AFTER
Tool used	2-bladed Reamer	Micro-adjustable boring bar
Carbide used	C-6	Wesson WH
Cutting speed, rpm	155	155
Feed rate per revolution	.012 ipr	.012 ipr
Machining time	(cycle unchanged)	
Tool change time	4 minutes	60 seconds
Pieces per tool change	100	400
Pieces per blade or insert, total	400	3200
Grinding cost, each	$0.875	None
Total grinding cost per tool	$3.50	None
Initial tool cost	$11.50	$0.72/insert
Total cost per 1000 pieces	$37.50	$0.22
Total tool change down-time per 1000 pieces	40 minutes	2½ minutes

Throw-Away Boring Tool Gives Better Finish Than Reaming and Cuts Tool Cost 90%

Wesson's micro-adjustable boring bars with square throw-away inserts replaced two-bladed carbide reamers in an automotive transmission plant with the following results, without change in output rate:

1. Down-time for tool changes cut over 90%.
2. Finish improved.
3. Consumption tooling cost reduced from $35 per 1000 pieces to 22 cents per 1000 pieces.
4. Reduced tool inventory.

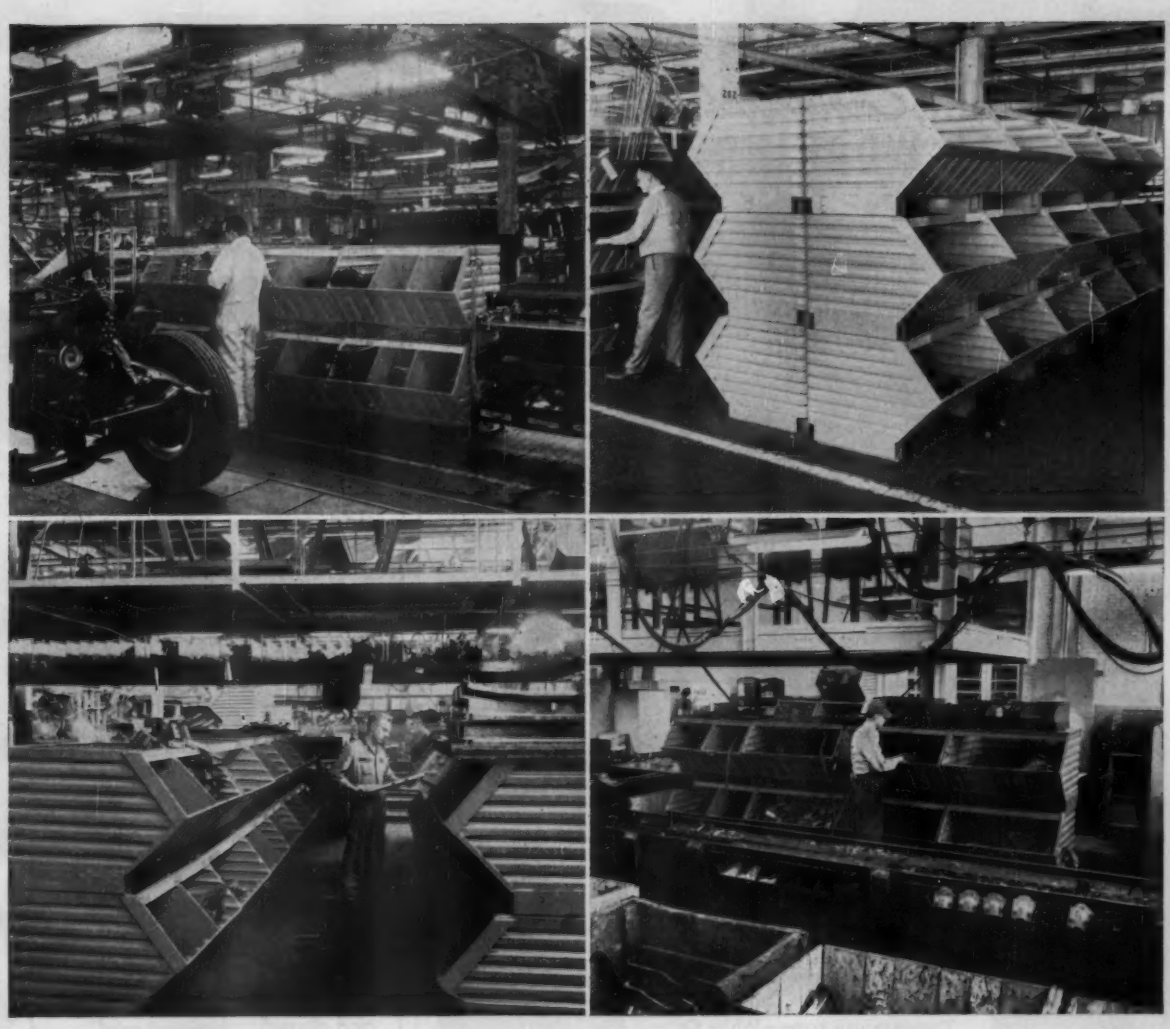
The parts are pearlitic planet pinion carrier housings of about 200 Brinell. Reamer output was 100 pieces per grind. This jumped to 400 pieces per cutting edge for the throw-aways. The number of shut-downs for tool changes was cut 75% and shut-down time per change also cut 75%. Net gain well over 90%.

Micro-adjustment is required only for initial setup. After that, simple indexing insures accurate adjustment. Inserts are of Wessonmetal WH.

PLANING WITH "THROW-AWAYS"

The planing operation shown here forecast some years ago that throw-aways were coming. It shows a Wesson MX-9 Multicut holder with a throw-away insert of Wesson's broad-range Grade 26 steel cutting grade, taking a ¾-inch depth of cut without any trouble on mill plate at 200 feet per minute. Planing is another of the big fields served by Wesson "No-Grind" tool holders and indexable inserts. Ask for Catalog #5510-M.

LITHO IN U.S.A.



Simplified Handling and "On-Stream" Inventory of a wide variety of parts and assemblies has saved International Harvester's Fort Wayne Motor Truck Plant substantial production hours and hundreds of feet of floor space. This saving was made possible by the new Powell designed tapered, open-end stacking unit that is equally efficient as a storage bin or a working hopper box. This is another example of Powell's long-recognized ability to design and build handling equipment to exactly meet job requirements.

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PRESSED STEEL
SINCE 1920

The Powell Pressed Steel Co.

HUBBARD, OHIO, DEPT. 937

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A Complete Line Including MICRO-KLEAN FIBER CARTRIDGE FILTERS

- **FOR COOLANT LIQUID SYSTEMS** . . . remove chips and grinding swarf from stream . . . insuring far finer finishes on surface and centerless grinding and machining operations.
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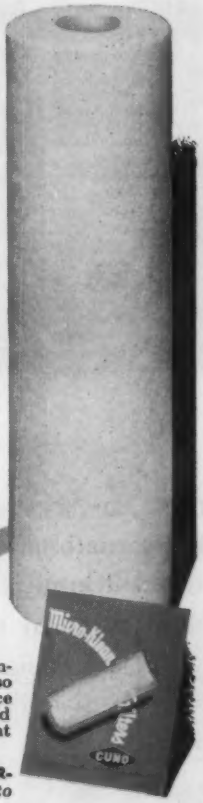
- **FOR PAINTING, FINISHING** . . . filter paint and air lines. Improve product appearance, protect against delays from clogged nozzles.

Two cartridge types – White Cellulose and Wool – provide filtration from 5 to 75 microns. Exclusive Cuno "Graded Density" feature *doubles* cartridge life . . . cuts replacement costs *in half!* A complete line of standard Cuno Housings is available for every application requirement.



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WRITE NOW FOR FULLY DESCRIPTIVE PRODUCT LITERATURE . . . *Free Micro-Klean Bulletins will be sent to you by return mail.*

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Understanding ALLOY STEELS

By removing the cloak of mysterious, highly technical terminology, this *American Machinist* Special Report clarifies the differences in commonly used alloy steels.

Alloy steel is just plain carbon steel to which one or more other elements are added to change some property or properties of the base material. These elements may affect the mechanical, magnetic, or chemical properties of the steel. This report discusses the relationship of alloy steel to plain carbon steel, and describes the alloy properties in terms of the standard classification.

This is one of a new series of *American Machinist* reports written to simplify metallurgy for the non-metallurgist. Earlier reports in the series discussed brass, and plain carbon steel.

25 cents a copy

READER SERVICE DEPT.

American Machinist

McGraw-Hill Building
New York 36, N. Y.

Scott Wipers are used for many wiping jobs at Allen-Bradley Company. Here a drill press operator cleans grease from the decimal scale. When used fresh from their "pop-up" box, these paper wipers carry no metallic particles to hurt workers' hands, or damage machines or parts.

WIPER PROBLEM? Look what Allen-Bradley did with Scott Wipers!

High laundering and replacement costs of cloth wipers were a problem in the Milwaukee plant of Allen-Bradley Company, a major manufacturer of motor controls and accessories. Several years ago, Allen-Bradley switched to Scott Wipers. Costs were reduced substantially, and workers appreciated the change to these disposable paper wipers.

Allen-Bradley uses Scott Wipers in various machine tool operations involving large drill presses and grinders, sanding machines, tapping and small drilling machines. Scott Wipers efficiently clean oil coolants from machines and parts. Operators especially like Scott Wipers for wiping oil from their hands—when used fresh from their "pop-up" box they are sanitary and carry no metallic chips which might cut or scratch.

Scott Wipers are 2-ply paper, chemically treated for wet strength and "perf-embossed." This exclusive process* makes them soft and highly absorbent. Want details? Phone the Scott distributor or write Scott Paper Company, Dept. AM-73, Chester, Pennsylvania.

SCOTT PAPER COMPANY

Makers of the famous Scott paper products you use in your home.
Consult your local TV schedules for Scott's program, "Father Knows Best."

*Patent pending

WILLIAMS-WHITE Hydraulic Gap Frame Presses

With Adjustable Pressure and Stroke

- Capacity .....100 Tons
- Table, R-L, F-B....96"x54"
- Daylight .....30"
- Stroke .....18"

This WILLIAMS-WHITE Hydraulic Gap Frame Press is of steel plate, welded construction with integral table. Furnished with sensitive hand lever control which is spring-centered to return ram to neutral position. A latch is also provided for holding pressure. Press has two double acting kicker pistons for rapid approach and return speeds. Gap Frame Presses can be built in capacities from 15 tons.

For details, write your nearest WILLIAMS-WHITE representative or direct to us.

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BY W. A. NORDHOFF
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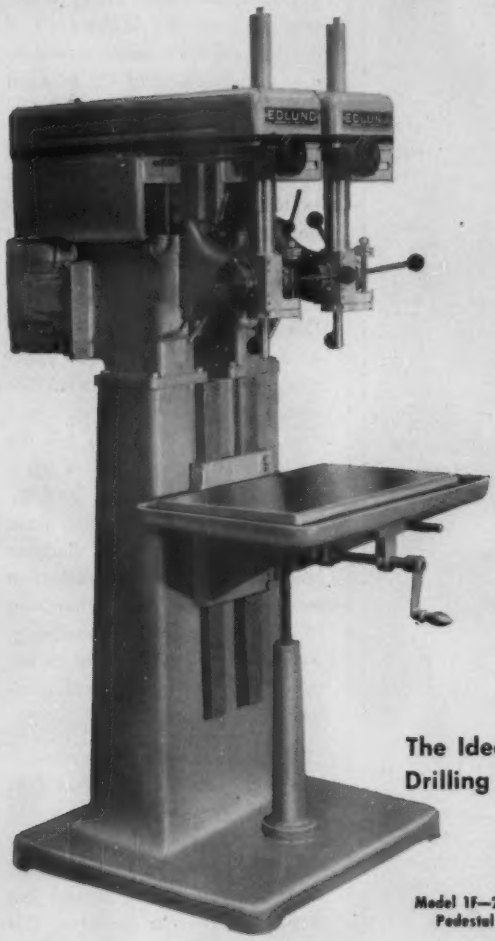
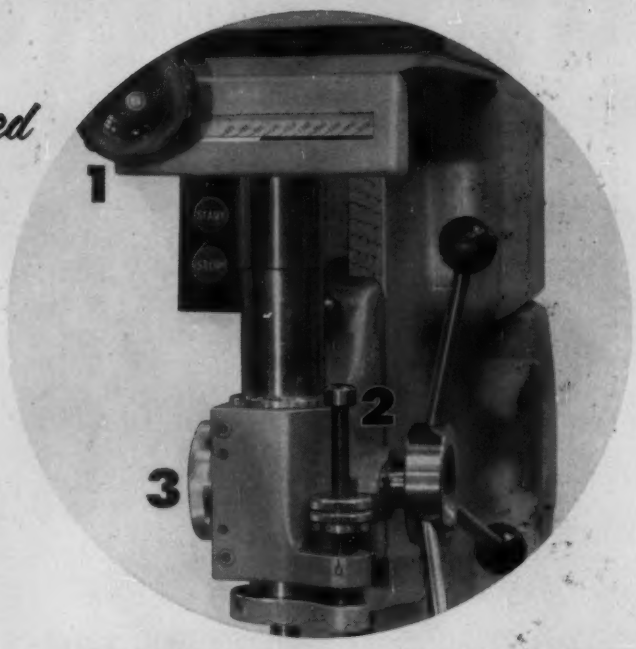
10,000 R.P.M.





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Simply turn knob for any speed within range of the machine. Swift, powerful, and positive action.

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Permits accurate pre-set depth control for all precision production drilling. Clearly graduated to .001".

3 ADJUSTABLE SPINDLE TENSION CONTROL
Compensates for different drilling conditions. Three handle feed lever reduces worker fatigue.

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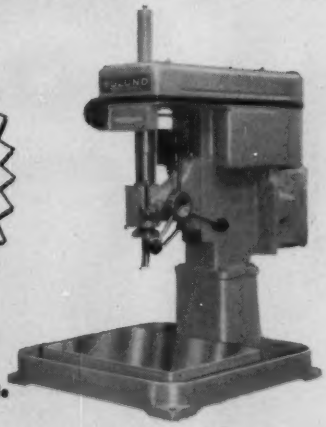
Model 1F—2 Spindle Pedestal Type

SPECIFICATIONS

Overhang	7"
Capacity (Cast Iron)	⅜"
#1 Morse Taper or Jacobs Chuck	0-⅛"
Speed Range — Optional	
625 to 5000 RPM	
1250 to 10000 RPM	
Spindles — 1 to 6	
Pedestal and Bench Types	

America's Most Popular Drilling Machine



Model 1F—1 Spindle Bench Type

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Division—Precision Castings Co., Inc., Subsidiary—Harrisburg Steel Corporation

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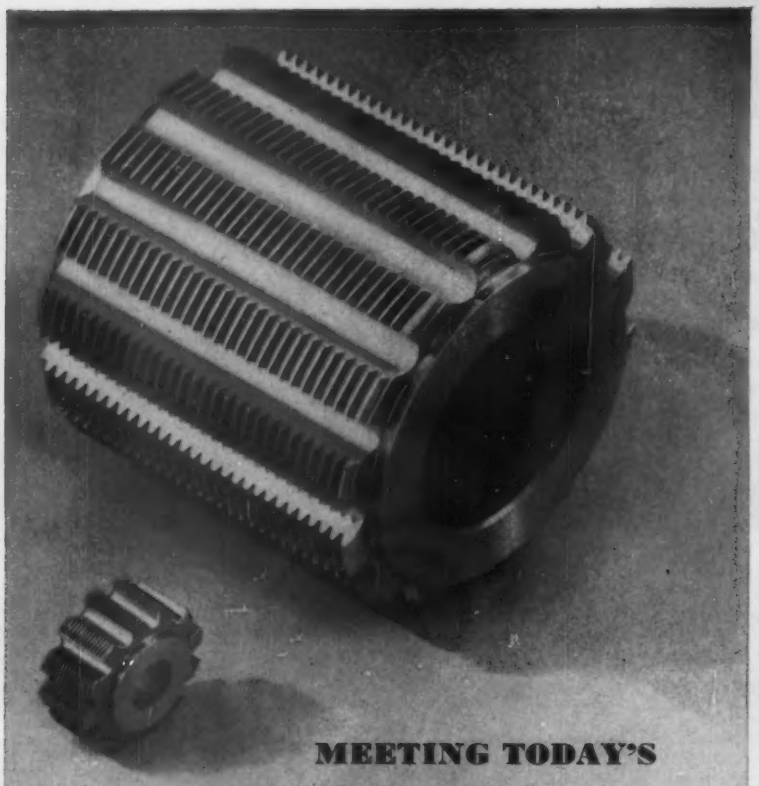

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Can You Compare...

. . . the age and types of production machinery and equipment in your shop with that: (1) in Metalworking generally (2) in each of this industry's 15 major manufacturing divisions, and (3) in each important geographical area?

You *can*, if you have a copy of the Seventh *American Machinist* Inventory of Metalworking Production Equipment. In fact, this Inventory is the only source for this vital information.

This exclusive *American Machinist* service gives you a true yardstick by which to judge the relative modernity of your shop . . . and then provides you with all the evidence you want to back up a decision to replace old and inefficient equipment with new. When you use it, you'll find, as have so many other production men, that there is no better way to arm yourself with convincing, authoritative arguments for an accelerated replacement and modernization program.

Originally, this seventh Inventory was a feature of the 1954 Production PLANBOOK issue of *American Machinist*, so you may already have its 96 fact-crammed pages on your library shelves. But if you need extra copies of this invaluable obsolescence report, you'll be glad to know that a limited supply of reprints still is available. Copies are $1.00 each. To get yours promptly, write or call . . .

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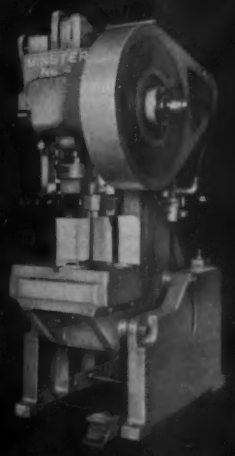
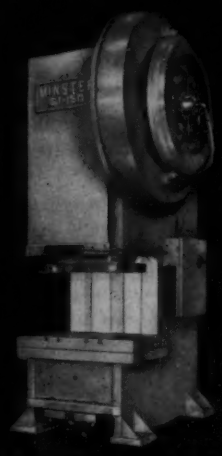
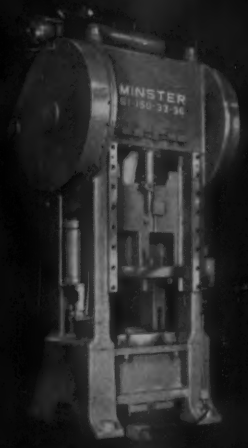


Open Back Inclinable Presses
12 tons through 200 tons

Straight Side Two Point Presses
50 tons through 500 tons

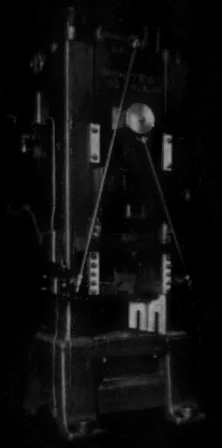


Fixed Base Single Point Presses
32 tons through 200 tons



Straight Side Single Point Presses
50 tons through 600 tons

Piece-Maker Automatic Presses
20 tons through 200 tons



Knuckle Joint Embossing Presses
150 tons through 1500 tons

Minster Press Lines not shown above:
Two Point Gap Presses inclinable or Fixed Base, 22 tons through 75 tons
Horning Presses, 12 tons through 95 tons.

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Minster, Ohio

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X Multiply the use of your surface grinder...

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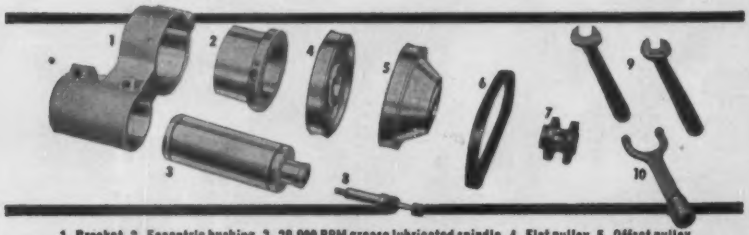
Most 6x18 surface grinders can now be used to finish small radii on dies or parts requiring small contour grinding by merely adding a Whitnon high speed surface grinder attachment. This assembly, in effect, creates an extra machine at little cost and increases the production range of your present grinder.

Whitnon surface grinder attachment comes as a complete kit, and can be shipped in a fitted wooden case. The offset pulley No. 5 makes it possible to reach into deeper holes and recesses than the flat pulley. Tapered arbors up to 4" in length available for direct wheel mounting if required.



1. Bracket 2. Eccentric bushing 3. 20,000 RPM grease lubricated spindle 4. Flat pulley 5. Offset pulley 6. Belt 7. Wheel & pulley mount 8. Collet type arbor 9. Arbor wrenches 10. Wheel & wheel mount wrench

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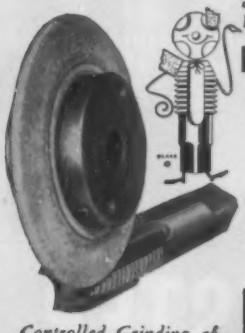

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Copper	18°	Magnesium	18°	Plastics	8°
Mild Steel	8°	Stainless Steel	12°		

Write for specific details on how the BLAKE Flute and Chamfer Grinders give you the accuracy you need for low tapping costs.

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More than 2000 pages! Over 1500 illustrations! Hundreds of tables, charts, keyed diagrams, symbols, definitions, equations, etc.

A small selection of highlights selected at random to illustrate the scope of this Handbook:

- Describes types of machines, cutting tools, tool holders, fixtures and operations in precision production boring.
- Includes all new techniques and processes of recognized acceptance including Powder Metallurgy, Investment Casting, Plastic Joining of Materials, etc.
- Conventional tables of feeds, speeds and cuts modernized to bring them into line with latest cutting tool materials and cutting practices.
- Treats, process-wise, such topics as Plaster Mold Casting, Superfinishing, Rotary Swaging, Sheet and strip cold roll forming, Die Hobbing, etc.
- Covers every phase of metal cutting and machinability.
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Gaging . . .

the Surplus Machinery Market

How's business? Most dealers agree that sales and inquiries are slower than they were a few months back, and a long way below year-ago record levels. While most tool centers report that price tags are staying high, here and there prices are starting to soften.

Consensus of dealers is that the market won't pick up in the near future—that most of today's business slowdown can be attributed to metalworking's hesitancy to go all out for expansion in the face of repeated newspaper inflation scare stories from Washington.

"The biggest used machinery auction so far this year" (the quote is auctioneer Tom Gagliardi's) was in many respects the year's most unusual, too:

First the size and scope of the auction—some 2500 machine tools of all kinds (assessed value $6.5 million, replacement value somewhere between $10-$12 million) went under the hammer March 5 and 6 at a warehouse on West 26th St in New York, and on March 7 in Hoboken, N J.

Second, the machines were all being liquidated by Aaron Machinery Co, New York, one of the East's biggest dealers and rebuilders. This meant that most of the machines had varying degrees of overhaul done on them. Consequently, for what is believed to be the first time at any such auction, the seller in most cases was willing to stand by a 30-day money-back guarantee.

Third, for the first time machines were auctioned off on a time-payment basis if the buyer so desired—and if his credit checked out OK. The requirements: prior submission of a bank rating statement, bank's evaluation of the account, and three letters of reference from bona fide business firms with which the prospective buyer had dealings. The buyer put down 25% in advance and if his credit proved out, was given as much as $100,000 credit on a 3-year basis.

Prices at the auction were pretty much in line, contrasted with 1957's other big auction, White Sewing Machine-Apex Electric in Cleveland, where prices for topnotch machines ran hog wild. Bids at the New York auction stayed around the same levels as they have in the last six months, with most good machines bringing about 90% of their original value.

Plenty of direct buyers were on hand, cornering most of the bids, but as auctioneer Gagliardi put it, "Dealers got the best buys."

Sample bids: an old Brown & Sharpe #5 8 x 24 in. hydraulic surface grinder in fair condition brought $1500; a Macut VFM vertical miller with speed multiplier brought $1000; a Monarch 14-in. AA x 30-in. centers engine lathe in good condition, with attachments, vintage 1940, brought $2750; a Gisholt #4 turret lathe (serial 722 x 5) with barfeed motor and some tooling brought $2500; a Cincinnati 2-18 production miller (serial 1B2P1K 336) with motor and controls brought $2700; a South Bend 13 x 42-in. centers quick-change gear lathe—old and in fair shape—brought $500; a Fellows model 20M Liner gear tester (serial 24095) with motors and controls, in fair condition brought $450; a Van Norman #12 milling machine (serial 5788) in good condition brought $1900.

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EVERY TIME!

AUTOMATICS
ACME GRIDLEY RA6 6-SPDL. 1⅛"
B & S 00G—High Speed—Slotting
B & S 00G Screw Threader—Vert. Slide —1950
B & S 2G 1½" Vert. Slide
CLEVELAND Model A 1-1/16" Single Spdl.
NEW BRITAIN #61 6 SPDL. 1⅛"

BOREMATICS
HEALD 48A Single End
HEALD 48 Double End—4 Heads
EXCELLO 2112A Single End

VERTICAL BORING MILLS
BULLARD 24" New Era—3-Jaw Chuck Table
BULLARD 42" — Spiral Drive — 4-Jaw Chuck Table

SURFACE GRINDERS
ABRASIVE 3B 8" x 24" Hor. Auto.
COVEL #20 6 x 18 Hor. Hydr.
DoALL D6 6 x 18 Hor. Hydr.—Selectron —Coolant—1953
NORTON 6 x 18 Hor. Hydr.
NORTON 6 x 18 Vert. Hydr.

ENGINE LATHES
AMERICAN 12" x 30" High Duty 12-Speed
AMERICAN 36" x 60" High Duty 12-Speed
REED-PRENTICE 20" x 78" 18-Speed

PROFILERS
P & W 12B M-1893 2-spdl. Vert.-Col. Raised 12"
P & W M-1402 30" 2-Spdl. Vertical

TURRET LATHES
B & O #2 1" Ram—Bar
B & O #7 2¼" Ram Chucker
GISHOLT #2 1¼" Ram—Bar or Chucker
GISHOLT #4 2" Ram—Chucker
GISHOLT #3 2½" Ram—Bar or Chucker
GISHOLT 1L 3½" Saddle — Taper — Threading
W & S #2 1¼" Ram—El. Bar Feed
W & S #3 1½" Ram—Chucker
W & S #4 2¼" Ram—Bar—Preselect.
W & S #5 2½" Ram—Bar—Preselect.

MILLERS
B & S #2 Light Type Plain
B & S #3B Standard Plain — Vert. Attach.
K & T 3H Vertical—Power Feed to Head

PRODUCTION MILLERS
CINN. 08 Plain
CINN. 08 R & F—1951
CINN. 2-24 Plain
CINN. 4-36 Hydromatic—2-way cycle

PLANERS
GRAY 36 x 36 x 12' Double Housing—1 Rail—2 Side Heads—1942

PLANER MILLERS
INGERSOLL 42 x 42 x 14' Adj. Rail Double Housing — 2 Swivel Side — 2 Swivel Rail Heads—1940

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SEARCHLIGHT SECTION

Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY

AUTOMATICS

9/16" Cleveland Model A, m.d., 1943
1-1/16" Cleveland Model B, m.d.
4 spindle 1¼" Cleveland, Model M, m.d.
4 spindle 2" Model K Cleveland, m.d.
4 spindle Model RAS National Acme—Acme Gridley, 2" cap., m.d.
2" Cleveland Model A, single spindle, m.d.
2½" Cleveland, m.d., Model A
No. 2A Cleveland, m.d., 3" cap., latest
No. 4D Potter & Johnston, m.d.
No. 5 DELX Potter & Johnston, m.d., late

BOLT THREADERS

Victor Nut Facing Machine, m.d., cap. ⅜" to 2" nuts
1¼" Landis 2 spindle, m.d.
1½" Landis 4 spindle, m.d.
1½" Landis Stay Bolt Threading Machine, Double Head, m.d.
No. 32B Oster Bolt & Pipe Threading Machine, m.d.

HORIZONTAL BORING MILLS

No. 1 Cleveland Horizontal Boring, Drilling & Milling, m.d.
5½" bar Betts Floor Type, m.d.
5½" bar Niles-Bement-Pond, m.d.
6" bar Sellers Floor Type, m.d.
7" bar Fitchburg, m.d., late
10" bar Sellers Floor Type, m.d.
Barrett Double End, 5" and 7" spindle, m.d.
Floor Plates—all sizes

VERTICAL BORING MILLS

18" Bullard Mult-Au-Matic, m.d.
24" Bullard Spiral Drive, m.d.
30" Bullard Man-u-trol Type, m.d.
42" Bullard Spiral Drive, m.d.
42" Bullard New Era, m.d.
44" Putnam, m.d., p.r.t.
48" Niles-Bement-Pond Car Wheel Borer, m.d.
53" Niles Heavy Pattern, m.d., p.r.t.
53" Niles Heavy Pattern, vee belt m.d., latest
102" Niles Wheel Turning Boring Mill

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 84" stroke Lapointe Single Ram Vertical Surface Broach, m.d., late
Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-42-15 American Vertical Dup. Ram Surface Hydr. Broach
No. 3 Oilgear Hydraulic Broach, type XA, 54" stroke, m.d.

RADIAL DRILLS

5'-14" col. American Triple Purpose, m.d.
5'-14" col. Carlton, m.d.
5'-15" col. American, m.d. on arm
6'-17" col. American Triple Purpose, m.d. on arm
7'-18" col. American Triple Purpose, m.d.
8'-17" col. Dreses, gear box m.d.
Baush Radial Drilling & Tapping Machine, m.d.

BALL BEARING DRILLS

No. 4 Foodick, 8" overhang, High Speed, m.d.
No. 15 Buffalo Floor Model, m.d.
No. ½, 1 & 2 Avey, m.d.
No. ½ Avey MA-8, m.d.
No. 1B Edlund, m.d., new
No. 4BM Foodick, single spindle, H.S., m.d.
1 spindle No. 2MA6 Avey High Speed, m.d., 7½" overhang, 1943
No. 2B—2" H.D. Edlund H.S., m.d.
2 spindle Allen, belted m.d., 8" overhang
2 spindle No. 2 Avey High Speed, belted m.d.
2 spindle No. 2B MA1 Avey Production Type, m.d.
2 spindle Avey, size No. 1, Type B, Style VHP, m.d., 8" overhang
2 spindle No. 3MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland-Gifford High Speed, 8" overhang, m.d.
2 spindle Leland & Gifford High Speed Hydraulic Type, m.d.
No. 2LMS Leland-Gifford, single spindle, High Speed, m.d.
No. 2LMS Leland-Gifford, H.S. Hydraulic Feed, m.d.
3 spindle No. 2MA6 Avey High Speed, m.d.
3 spindle Leland & Gifford #1 LMS—High Speed, m.d., late
3 spindle Leland & Gifford High Speed, m.d.
3 spindle Delta H.S., 4 speed vee pulley drive
4 spindle Leland & Gifford, m.d. on each spindle
6 spindle Leland & Gifford, m.d. on each spindle. No. 2 taper
6 spindle No. 1 Avey High Speed, m.d.
6 spindle Model M 1015 Pratt & Whitney In Line Vertical, m.d.

HORIZONTAL DRILLS

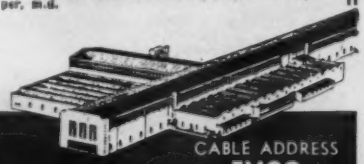
No. 2 Avey Style MA 1, with horizontal operation
3 way Natco Horizontal Drill, consisting of 3 E13 Heliounits
No. ½ 0x50" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d., latest
No. 1½x105" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1 Pratt & Whitney 2 spindle Deep Hole Drill, belted m.d.
Model 410 W.F. & John Barnes, 2 spindle Hydraulic Deep Hole Drill, m.d.
Pratt & Whitney Deep Hole Sharpener, m.d.
Natco Horizontal Drill, holesteel model, m.d., 1942
Natco Horizontal Drill, 2 opposed B4F2 Heads, 1943
¾"x40" Bausch Double Horizontal Drilling Machine, m.d.

MULTIPLE SPINDLE DRILLS

No. 3 Baush, m.d., 16x30" head
3 spindle 28" Cincinnati-Bickford Upright Drill, m.d., No. 4 M.T.
No. 924 Barnes Vertical Drilling, Boring, Facing & Reaming Machine
6 spindle W.F. & John Barnes Vertical Drilling Machine, m.d.
3 spindle Rockford 12" Gang Drill, m.d.
4 spindle No. 20½ Barnes H.D., m.d.

UPRIGHT DRILLS

20" Barnes All Geared Self-Oiling Drill & Tapper, m.d.



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1 spdl. 20" sw. #2LMS L-G, 1945
1 spdl. 21" sw. #112 Defiance, 1942
1 spdl. 24" sw. #2MA6 Avey, new 1942
1 spdl. 26" sw. #4MS L-G hydraulic
2 spdl. 24" sw. #2 Avey, AC MD
3 spdl. 20" sw. #2LMS L-G, 1942
3 spdl. 24" sw. #3MS L-G, new 1943
6 spdl. 20" sw. #1LMS L-G, new 1942
15 Ton, 60" Stroke, Colonial Vert. Broach
16 spdl. Fox #K60H, #2 taper, 1944

GRINDERS

3"x12" #5 B&S, 1942
3"x18" #5 B&S, 1943
4"x12" #4H Landis, new 1942
6"x18" Norton Type C, new 1942
10"x18" Norton Type C, new 1941
10"x36" Norton Type C, new 1943
10" (28" sw.) x 48" Cinn. ES, 1943
10"x50" Hill-Clarke, AC Mot. Dr.
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"x20"x36" Norton, angular wheel
14"x72" Norton Type C, new 1941
14"x96" Hill-Clarke, AC Mot. Dr.
16"x20"x84" Norton, 1942
16"-40"x96" Norton Gap, 1942
16"x72" Hill-Clarke, AC Mot. Dr.
18"-36"x72" Norton, AC MD 1941
18"x120" Norton, AC MD
20"-32"x144" Norton Pl. Cyl.
20"x36" Norton, Hi-Swing
24"x84" Norton, AC MD
42"x72" Norton, extras, new 1947
#5A Bryant Internal, new 1942
#16A-16 Bryant Internal, new 1942
#16-38 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Sissmatic, 1944
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc, 1940
3B Abrasive Surf. 8"x24", 1943
#18-30" Blanchard Rot. Surf.

LATHES

16ML-16"x36" LeBlond Auto.
12"x28" Lipe Carbo Semi-Auto
12"x32" Fay Automatic
12"x48" Fay Automatic
27"x84" Amer. Grd. Hd. MD
24"x42" Fay Auto. AC MD
36"x120" Putnam Grd. Hd., MD
R14 Seneca Falls, 16"x36", 1942
120"x96" or N-B-P, ser. 3380
#5W Cinn Acme Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-10 Libby H.D. Tur. 1943
#4A W&S Turret Ser 33999
4FU Fastermatic, tur. 28" sw 1944
8D Potter & Johnston, new 1941

MILLERS

54"x30"x16" Ingersoll Slab, 1934
54"x60"x8" Ingersoll Openside, 1942
Davis & Thompson Vert. 1944
#12-B Pratt & Whitney Profilers
10"x60" P&W Mod. B Thread Mill
#LT 6"x72" L-B Thread Mill
#HT 12"x24" L-B Thread, 1942
#CT 24"x36" L-B Thread, 1942
#128 Van Norman Prod. 1942

PLANERS

36"x36"x12' Rockford Openside '42
60"x48"x27' American, 4 hds.
60"x48"x30 Hamilton, 4 heads

MISCELLANEOUS

36" Rockford Hyd. O.S. Shaper, 1950
6" Goss & DeLeeuw 8 spdls. 1941
#306 Barnes Vert. Hone, new 1942
#11RD 2 Hd. W&S Tapper, latest
#36BM G&E 3 Spdl. Bevel Gear
612-A Fellows Gr Shaper 18" cum
#HRSBarber-Colman Sharp Mach
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Ohio 24" M.D. All Grd. Feeds Shaper 1942 model
Cincinnati No. 5 Rest. Overarm Grd. Hd. Plain Horiz. Miller.
Baush 44" Vert. Boring Mill 2 heads.
American Vert. Hyd. Broach 48" str. 15 ton cap. 1947
American 20"x8' Grd. Hd. Lathe motor in base.
Landis 20"x72" and 18"x96" Plain xt. Grinder.
Hanchett 25 H.P. Sp. Vert. Hydr. Surf. Grinder 12"x48" table
W&S No. 2-A Grd. Hd. Univ. Turret Lathe
Bliss 200 T Cap. S.S.S.C.B. Grd Press 8" Str #77
Rivett No 104 A.C. M.D. Internal Grinder. 1942.
Milwaukee Nos. 2-D & 3-B Horiz. Plain Millers.
DoAll 16" Job Selector Metal Saw, 1950 Model.
Cincinnati 96"x36"x10' D.H. Planer 2 Hds. Box
Amer. 6' Radial Encl. Hd. 10" Col. 32-Sp. Speeds.
Amer. 4 Radial 12" Col. Encl. Hd.
Bliss #6N BG. Stiles Type Press
Cincinnati No. 2 Hi-Power S.P.D. Vert. Miller.
B&S #2A Grd. Hd. Horiz. Univ. Miller.
Barnes 20" All Grd. Camel Back Drill 1-Sp.
Blanchard M.D. Vert. Sp. Surf. Grinder 26" chuck.
Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Ret. Surf. Grinder 12" chuck 1942.
Landis 2-Sp. 2" Cap. Bolt Threader M.D.
Hendey 16"x8' bed Q.C.G. Lathe 1939.
G & E 24" Gear Box Shaper Tilt. Table Top.
Newton 48" Table 1-Sp. Cent. Vert. Miller.
Foster 2-F Fastermatic Hyd. Turret Lathe.
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P & J #2 Auto. Prod. Miller, 2 Tables.

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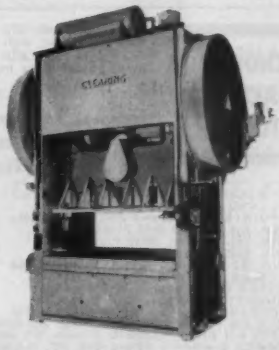

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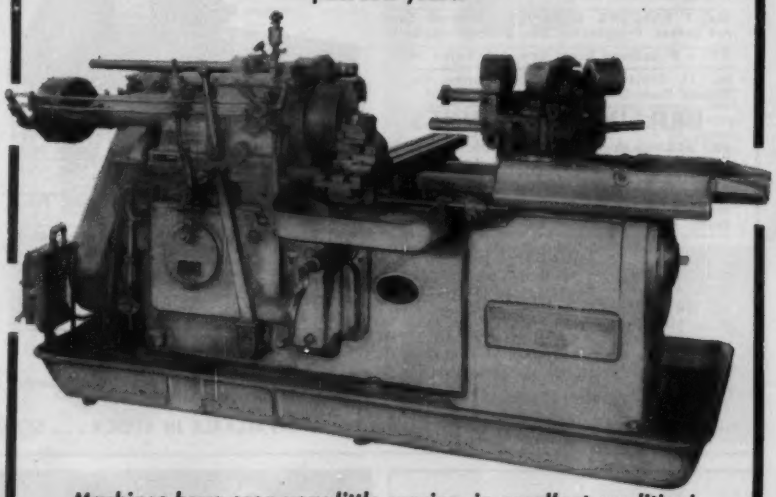

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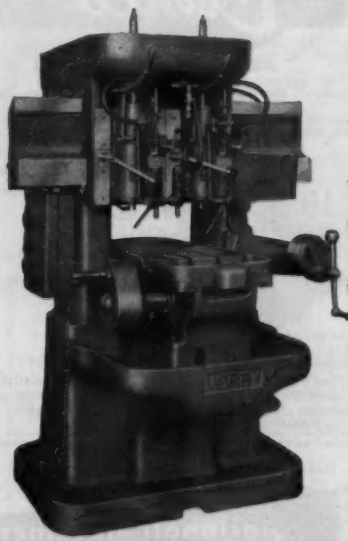

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CINN. Cyl. Grinder, 18x72 Plunge 1943
CINN. #2 Centreless; Grinder Filmatic 1944
EXCELLO #33 Thread Grinder 1942
NORTON Cyl. Grinder, 6x18 Plunge 1944
HANCHETT #900 Face Grinder 1944
ROCKFORD Hyd. Vert. Shaper, 12" st. 1944
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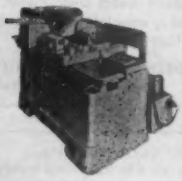

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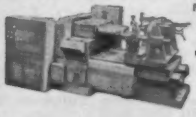

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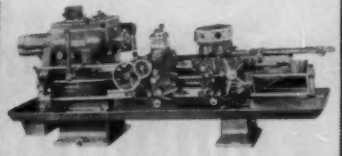

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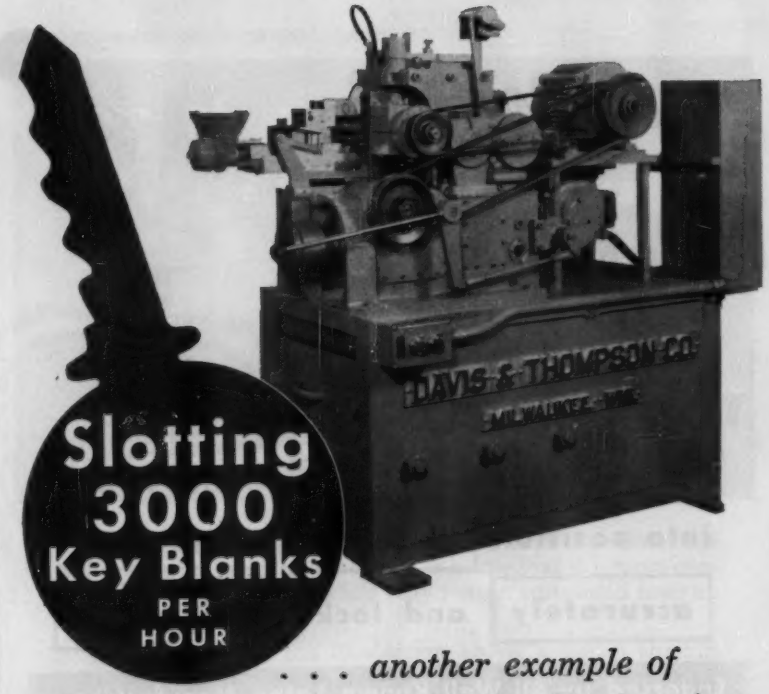

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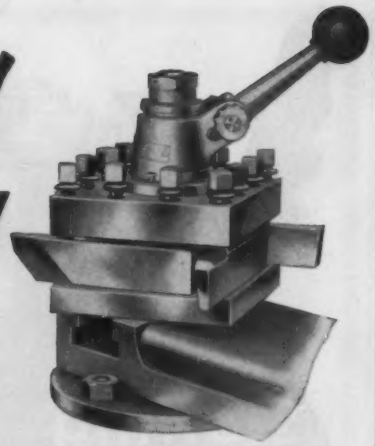

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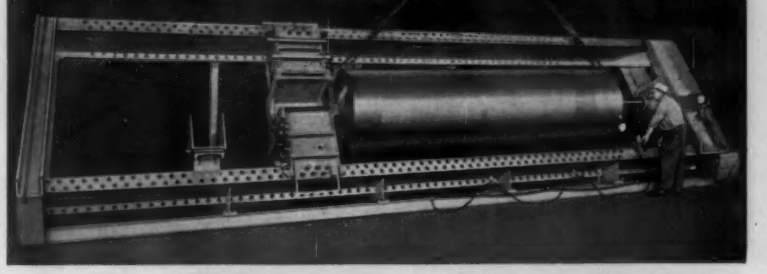

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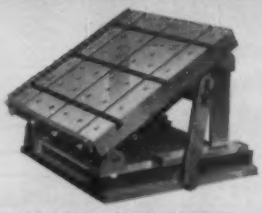

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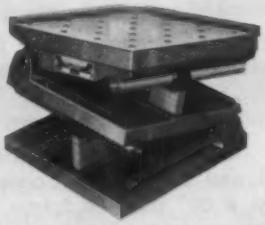

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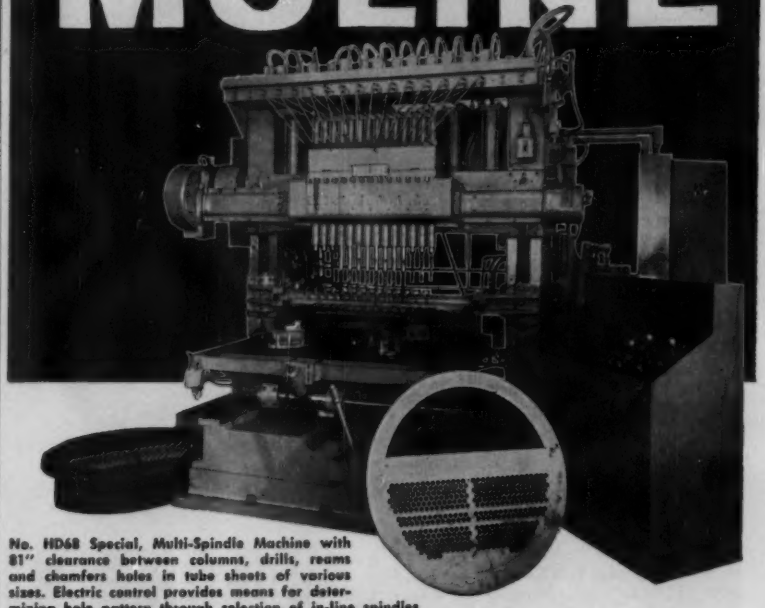
MOLINE



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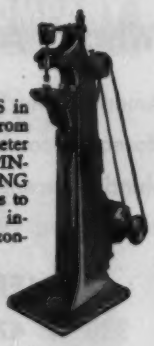

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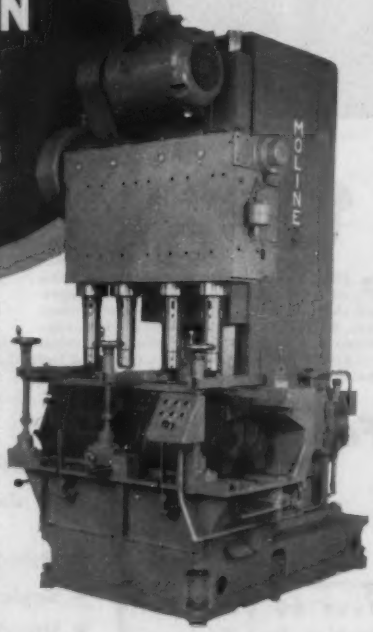

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AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

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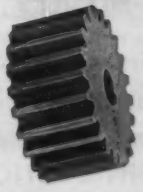

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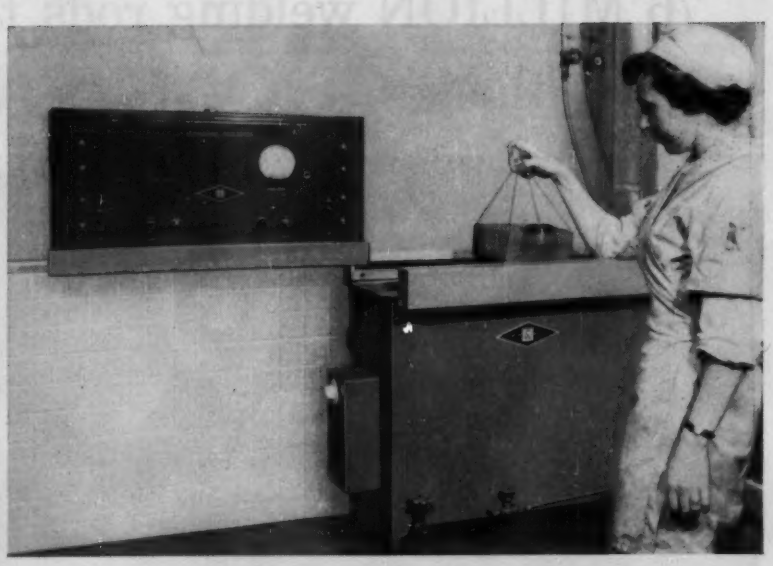

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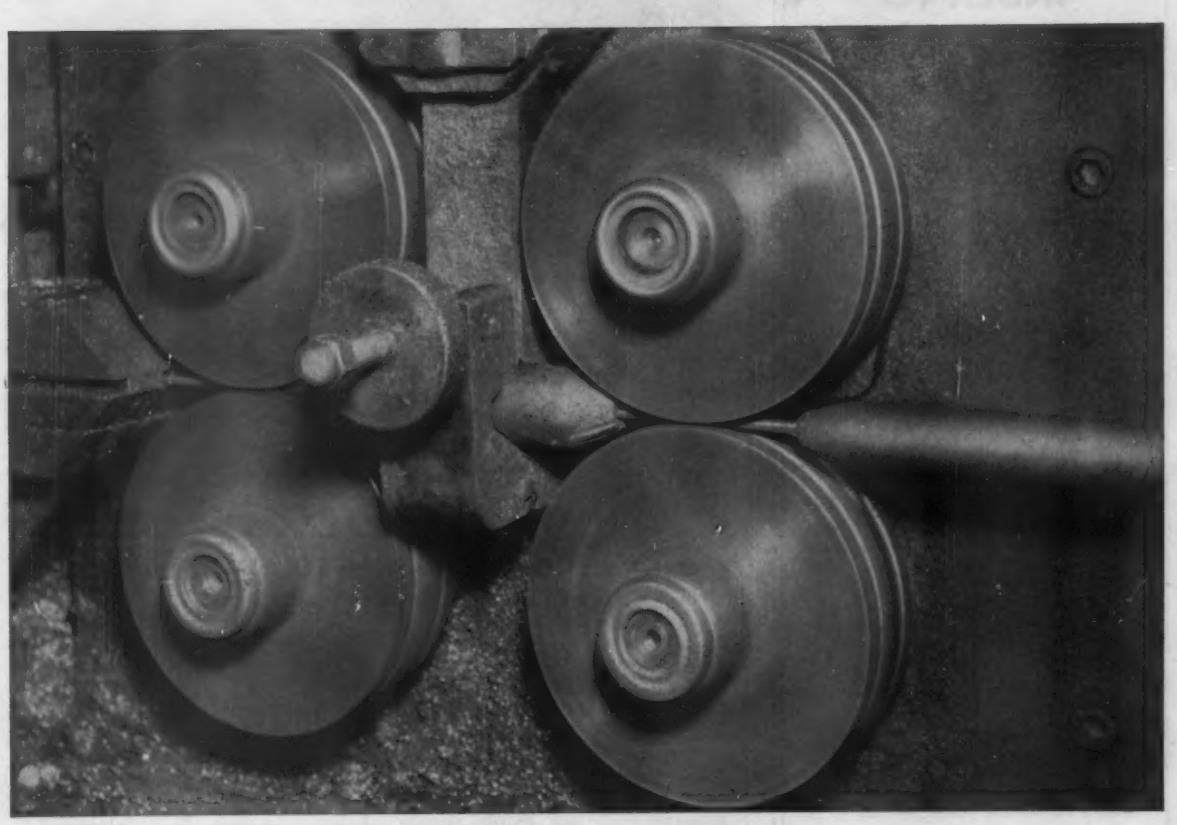

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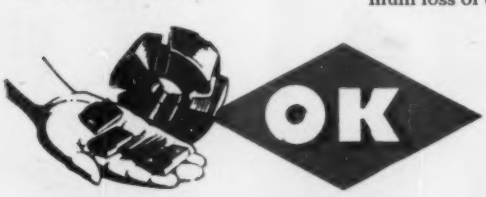

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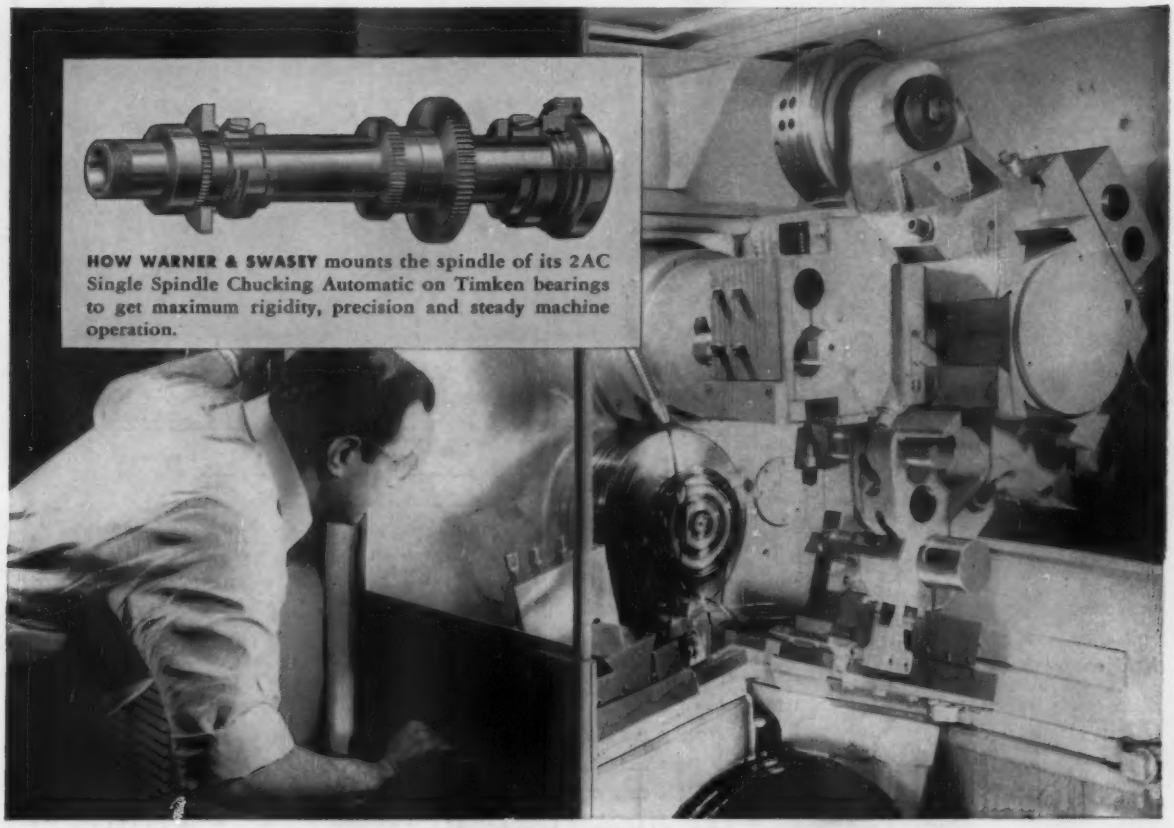

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